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Introduction

The X5 marks BMW's introduction into the luxury "Sports Activity Vehicle (SAV)" niche segment of the Sport Utility Vehicle market. While carrying the designation X5, the vehicle is not based on the 5 Series but it is its own new car-like platform. The X5 is offered with two engine variants:

- The 4.4 liter M62 TU engine equipped with the A5S 440 Z automatic transmission.
- The 3 liter M54 engine with either the GM 5 automatic (A5S360R) or 5 speed manual transmission (S5D280Z).

The X5 incorporates the following features:

- Four wheel independent suspension (BMW tradition)
- Full time - all wheel drive (planetary gear transfer case)
- All road vehicle (ON/OFF road capabilities)
- High ground clearance
- Unitized body and Chassis (car like ride and handling)
- Double pivot front suspension
- "Integral Link" rear suspension with air spring self leveling
- X5 specific traction control system


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Two different suspension options are offered (standard and sport) with different springs, shock absorbers and stabilizers.

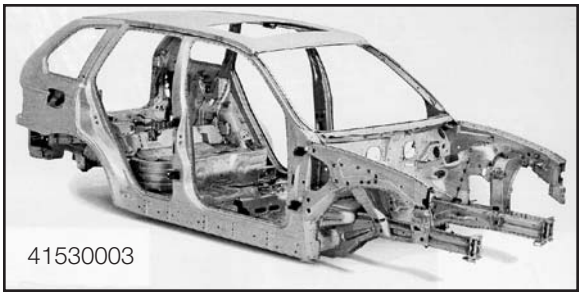
The X5 has 180 mm ground clearance, for both suspensions to allow off road travel. However, the suspension travel is the same as the E39 which allows the X5 to retain a car like feel when driven every day.

Body

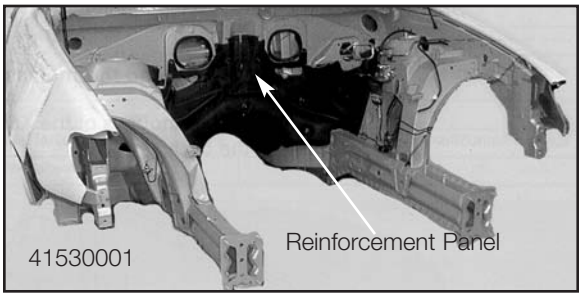
The design of the X5 originated in California at BMW's Design Works. The SAV look was further developed and refined in Munich. Traditional BMW features such as the Kidney grilles, quad headlights, reverse link rear side window trim and typical rear tail light treatment allow the X5 to assume a BMW identity. Yet the unique side and hood treatments as well as the large wheel house openings and high ground clearance set the X5 apart as its own distinctive vehicle.

The design criteria for the X5 was to develop a vehicle with the superb handling and sporty driving characteristics that are typically BMW, yet produce an all wheel drive vehicle that can also be used off-road. This was achieved through the use of independent front suspension and multi-link rear suspension components that are taken from the E38/E39 vehicle design and expanded by the addition of front drive components.

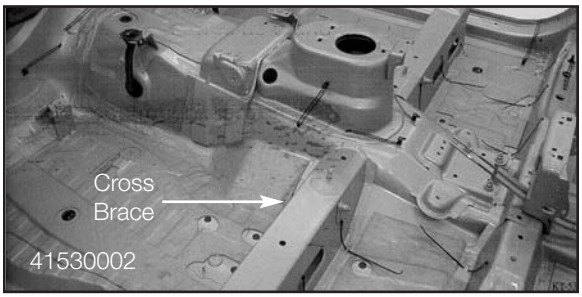
The entire body shell/frame assembly of the X5 is reinforced to ensure optimized body rigidity.



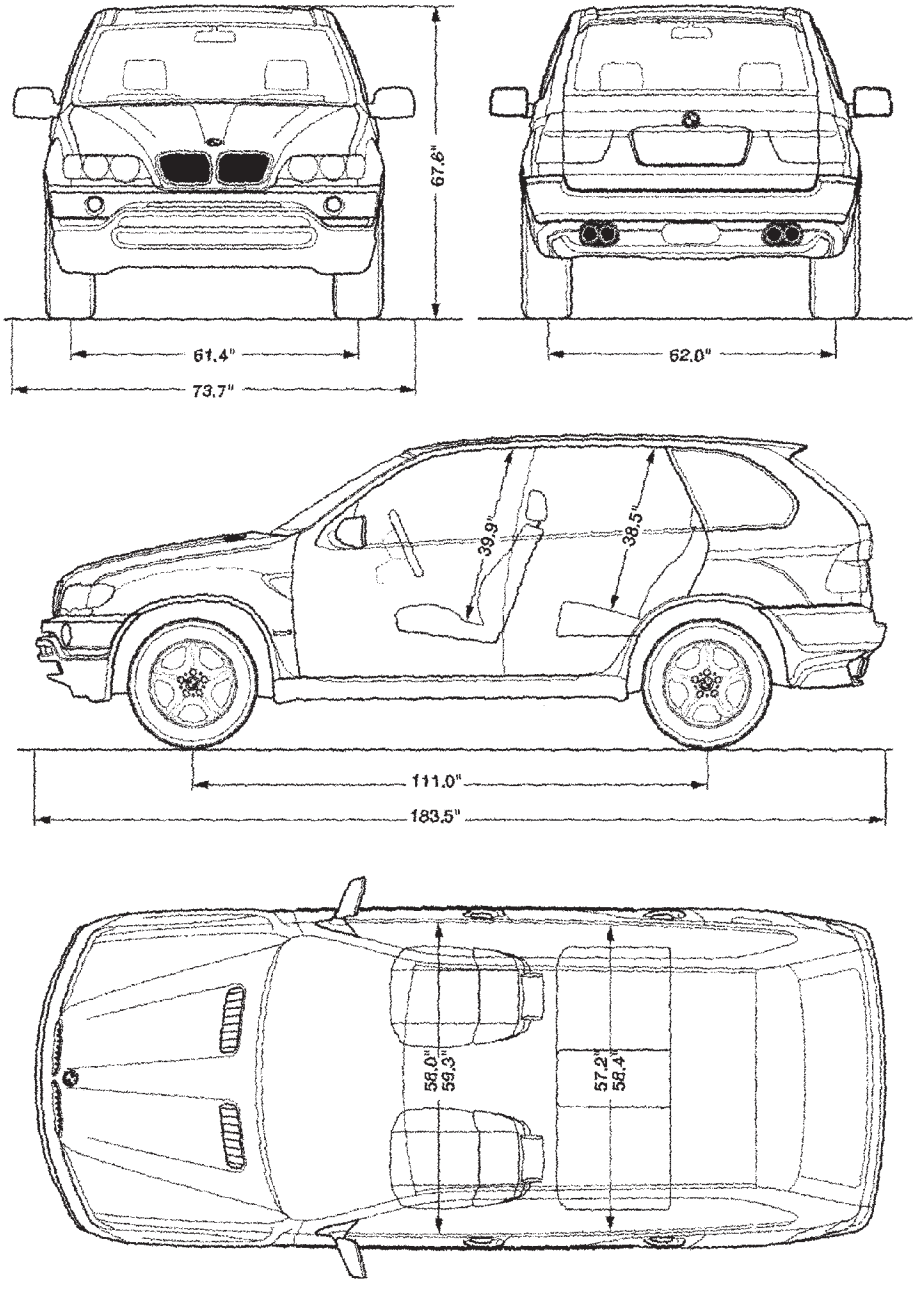
In addition to the cross bracing on the front suspension/engine carrier, an additional panel is installed between the bulkhead and transmission tunnel.



The floor pan of the X5 is reinforced with additional ribbing and cross braces to increase the lateral rigidity. A continuous seat cross brace is connected to the floor pan and side sill for reinforcement.



Specifications



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Specifications

DImensions:			
	X5 3.0i	X5 4.4i	X5 4.6is
Doors	5	5	5
Length	4666 mm	4666 mm	4666mm
Width	1872 mm	1872 mm	1872mm
Height	1717 mm	1717 mm	1717mm

Engine:			
	X5 3.0i	X5 4.4i	X5 4.6is
Designation	M54B30	M62 TU B44	M62 TU B46
Engine Management Syst.	MS 43	ME 7.2	ME 7.2
Horsepower (HP)	225@5900RPM	282@5400RPM	340@5700RPM
Torque	214@3500RPM	324@3600RPM	350@3700
Bore	84mm	92mm	93mm
Stroke	89.6mm	82.7mm	85mm
Compression	10.2:1	10.0:1	10.5:1

Vechicle Weigth withTransmission:			
	X5 3.0i	X5 4.4i	X5 4.6is
Automatic	2015 Kg	2085 Kg	2188 Kg
Manual	1990 Kg	Not Available	Not Available

General			
	X5 3.0i	X5 4.4i	X5 4.6is
Fuel	92l	92l	92l
Drag Coefficient	0.35	0.36	0.38
Payload	610 kg	555 kg	N/A
Roof Load	150 kg	150 kg	150 kg
Gross Weight Manual Trans.	2600 kg	Not Available	N/A
Gross Weight Auto Trans.	2625kg	2650kg	N/A
Cargo Volume	16.1/54.4 cu ft.	16.1/54,4 cu ft.	16.1/54,4 cu ft.
Towed Weight Braked Manual	1600 kg	Not Available	N/A
Towed Weight Braked Automatic	1700 kg	750 kg	N/A
Turning Circle	39.7 ft.	39.7 ft.	39.7 ft.

Hood/Front Grille

The hood on the X5 is distinctive, with two IHKA air intake hood scopes in the center leading down to the traditional BMW twin grilles.

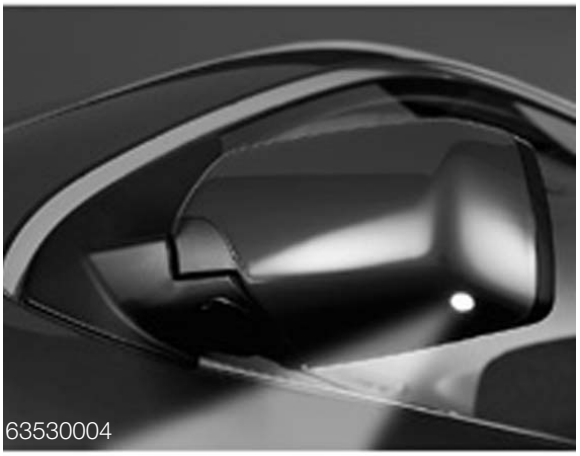
Workshop Hint:
Hood prop tool number 90 88 6 512 170

The grilles are integrated into the hood with the secondary hood latch springing out from the grille when the hood is opened.

The four round headlights complete the front end with Xenon low beans as an option for the X5. The fog lights as well as the headlight washers are integrated into the bumper.

Doors/Mirrors

The doors on the X5 incorporate side bars which serve as side impact protection without the use of the metal hooks found on the sedans. The mirrors are aero style that includes cascade lighting at the bottom of the mirror for vehicle entry at night. The lights are switched on when the vehicle is unlocked to light the ground around the door. The cascade lighting is optional. Control relay for the cascade lighting is located in the electrical carrier above the glove box.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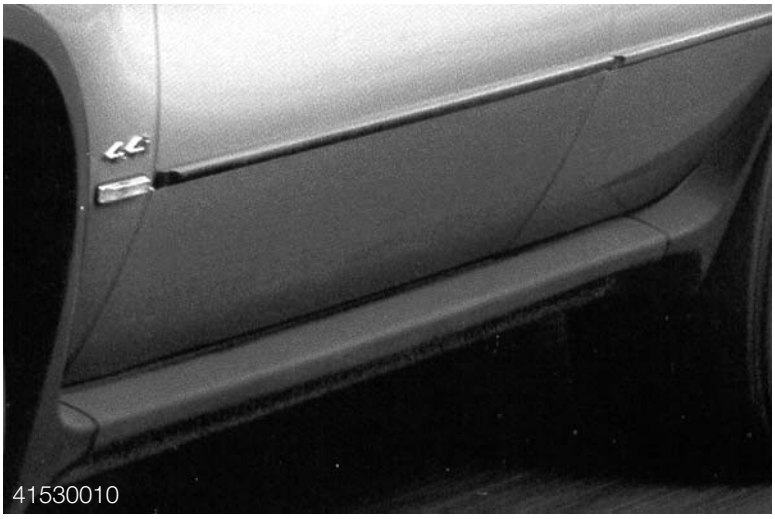
Running boards, integrated into the rocker panels, provide ease of entry on the left and right sides.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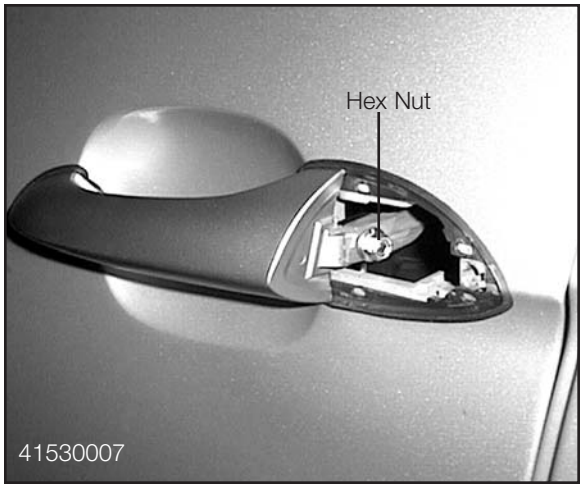
Door Handle

The door handles are similar in design to the E46 and pull out and upward for opening. Removal of the handles is also similar to the E46.

There are no serviceable components on the lock/latch. The assembly must be replaced as a unit.

The lock cylinder is removed by removing the torx screw through the access hole in the door. Once the screw is removed, the lock cylinder can be pushed out of the handle assembly.

The handle is removed by loosening the hex nut holding the handle to the latch mechanism.



The handle is then removed by pulling it out and down to release it from the latch. The handle is turned down to the left to release it from the door latch assembly.

Interior/Seats

The instrument cluster and dashboard layout is similar to other BMW models with all of the controls in easy reach of the driver. The instrument cluster variations (high and base) are taken from the E39 as are all driver information electronic systems.

High Cluster

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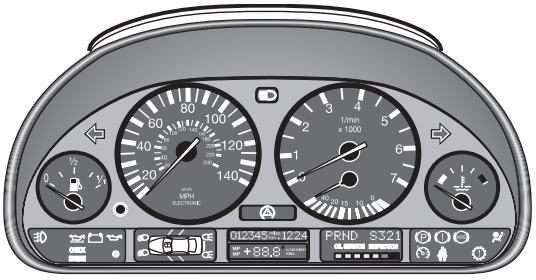
Base Cluster



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The center console contains the radio or navigation system and the climate control panel along with the central switch panel (SZM).

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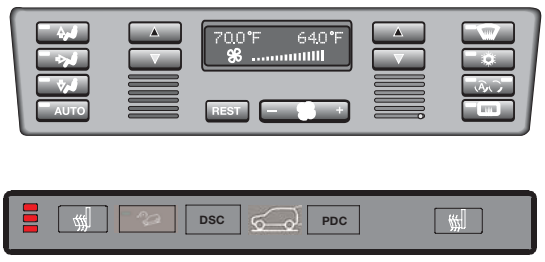

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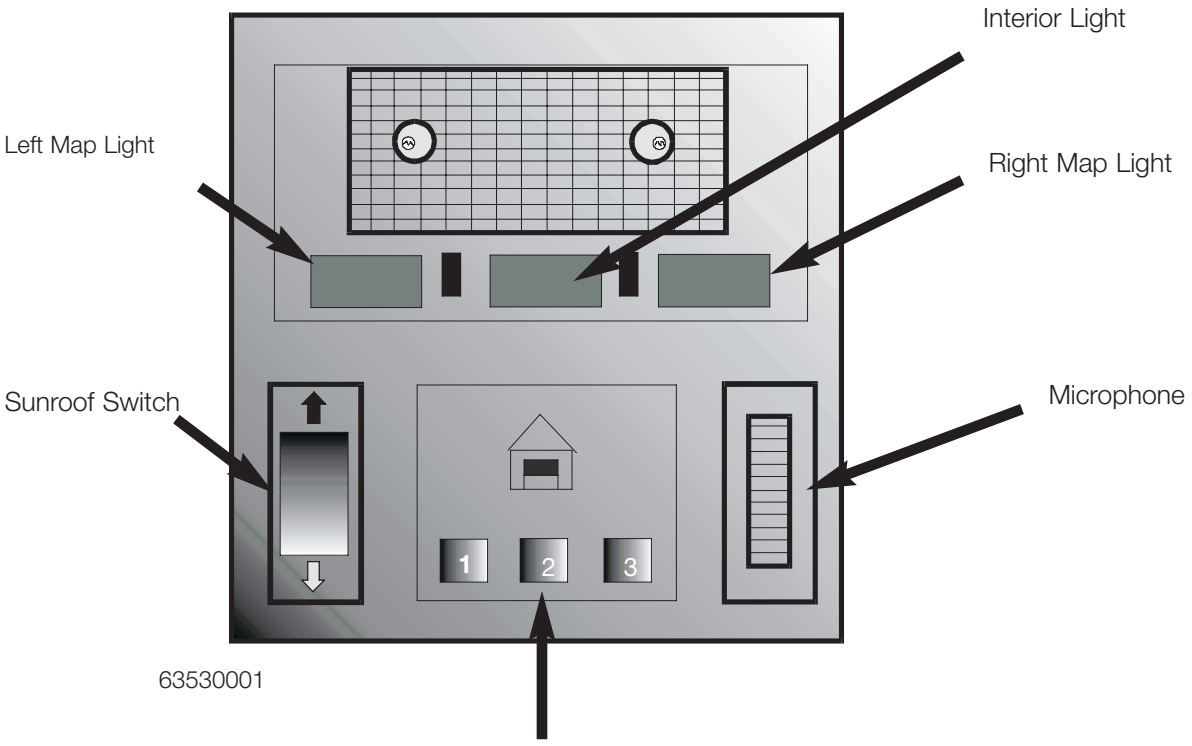
Interior

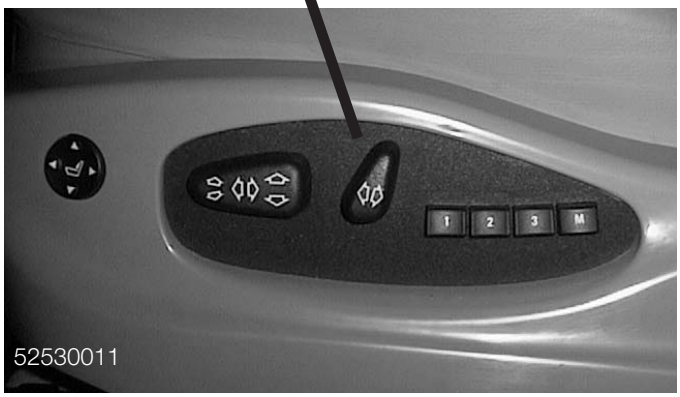
Located above the windshield in the center is the overhead console that contains the universal remote switch panel, interior lighting/map panel, sunroof switch and grille for the telephone hands-free microphone. The light panel contains a single bulb which is controlled by the ZKE, as well as two map reading lamps. The switch provides a ground signal which the GM recognizes as a request to either turn the interior lights on or off. If the switch is held > 3 seconds, the lights are switched off in the work shop mode as on other models.



Incorporated into the overhead console, behind the universal remote switch, is a sunglass storage compartment

Interior/Seats

Two interior seat options (comfort and sport) are available for the X5. The seats are mounted high in the cabin for good visibility and offer 8-way power, memory adjustments with lumber support. The seat/mirror memory control module and switch assembly is located on the side of the driver's seat.



Rear Seats

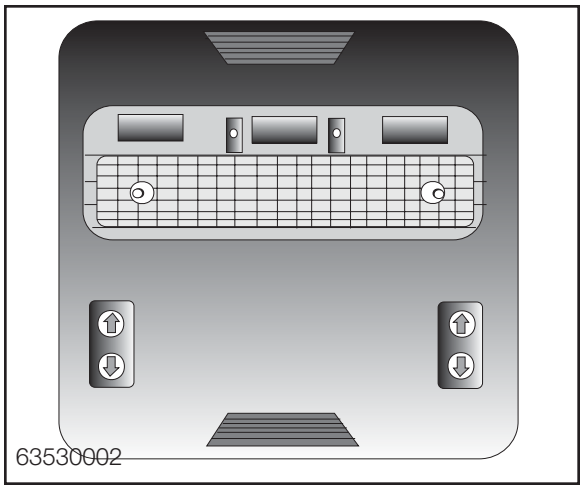
The rear seating area on the X5 offers 1472mm width and 977mm of head room for comfortable seating for the rear passengers. Rear cup holders are installed in the center console below the IHKA outlet grilles which incorporates a separate blower fan for the rear seating area.

The rear seats have a 60/40 split with the fold down center arm rest on the left seat back. The center arm rest also includes the optional folding ski bag.

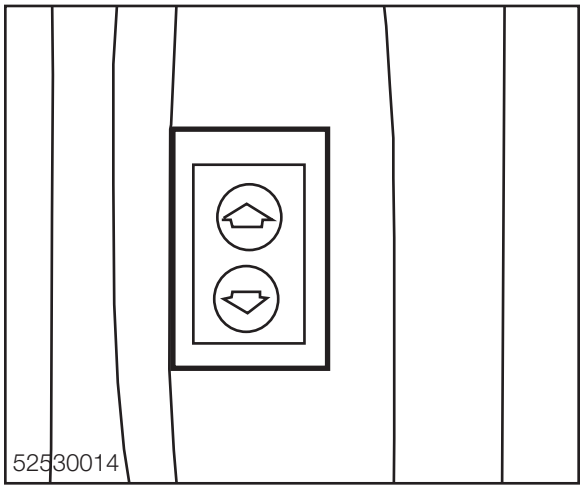
Rear Seat Backrest Adjustment

Electric rear seat backrest adjustment is available on the X5 as optional equipment. Each backrest can be adjusted individually up to 20 degrees. the backrest adjustment option consists of the following:

- Left/Right adjusting motors with gear drive and seat back hooks - located behind the seat backs on the shock towers. The rear seat backs lock into the “D” shaped hooks on the backrest adjustment linkage.



- Left/Right adjusting switches - located in the interior light housing in the head-liner panel.



- Left/Right adjusting switches - located in the rear on the left and right sides of the “D” pillar behind the upper tailgate.

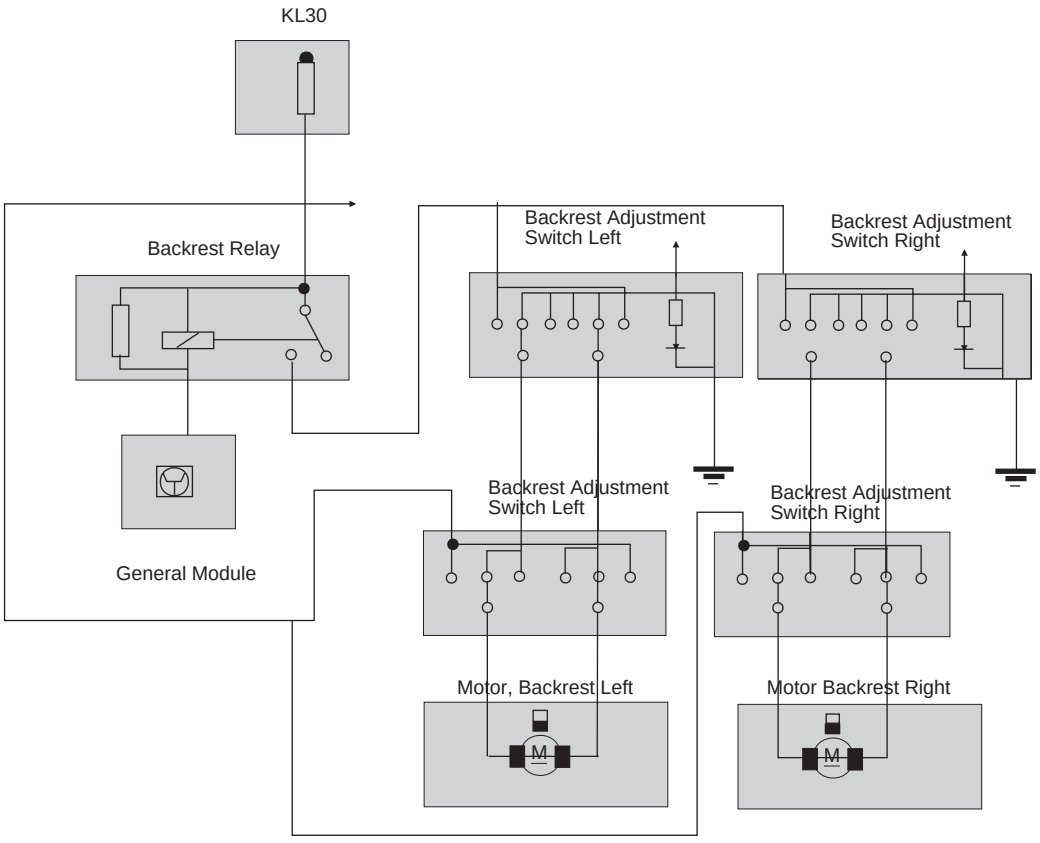
System Operation

The seat backs are adjusted from the two different locations as follows:

- The switches in the interior light housing receive operating power through the seat back relay when the ignition is switched on KL 15. The GM controls the operation of the relay and the switches provide the ground.

- The switches in the “D” pillar receive KL 30 and allow seat back adjustment whenever the rear tailgate is opened to gain access to the switches.

- The adjustment motors receive power and ground directly from the switches.



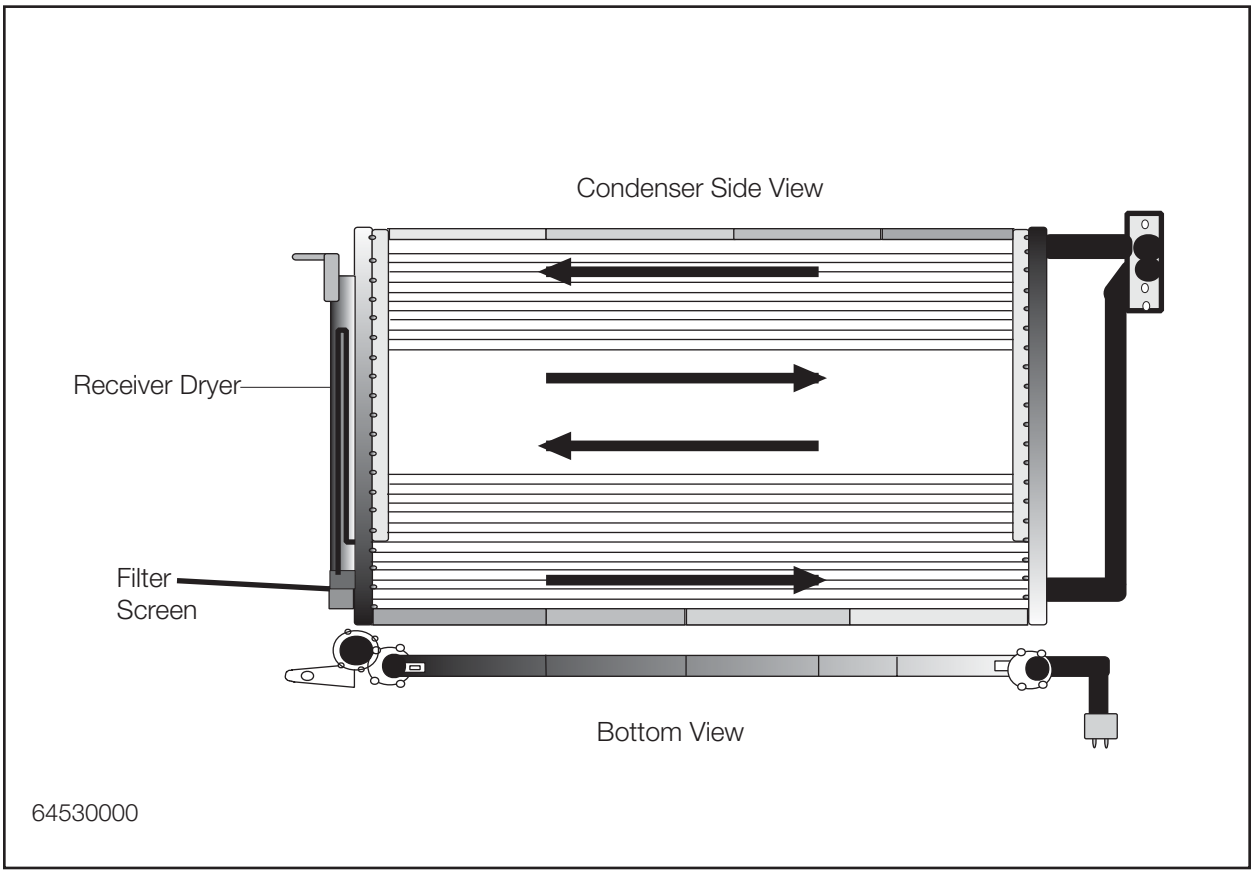
Climate Control Systems (IHKR/IHKA)

Two climate control systems are offered on the X5, the manual IHKR system is standard equipment on the 3 liter X5 and the IHKA system is available as an option. The IHKR is a new system for US production and the IHKA is taken from the E39 vehicles.

Condenser/Receiver Dryer

The X5 incorporates a new design air conditioning condenser/receiver dryer for both the manual (IHKR) and the automatic (IHKA) systems. The dryer cartridge and condenser are one component with the dryer integrated on the left side. The dryer cartridge contains a replaceable filter screen and dryer unit.

The condenser is partitioned which divides the condenser into cooling sections. The hot refrigerant flows across the condenser and into the dryer through inlet holes at the lower 1/3 section of the cooling fins. After the refrigerant passes through the dryer it returns to the evaporator through the outlet hole and bottom 1/3 section of the condenser.



Climate Control System (IHKR)

The manual system is controlled through the use of bowden cables for air distribution and electronic control for temperature regulation and blower speed. One stepper motor is used for the fresh/recirculated air intake.

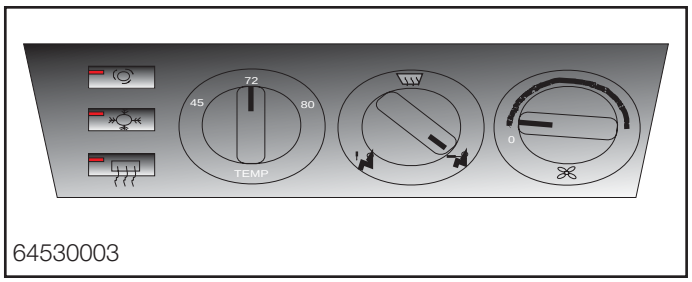
The IHKR incorporates the following features:

- Fresh air intake grilles integrated into the hood - the fresh air passes through the single micro filter installed in the center of front bulkhead.

The air then passes through the air duct, which is bolted to the bulkhead, and enters the heater - A/C unit through the non-return flaps.

IHKR Control Unit

- Integrated control module with operating panel.



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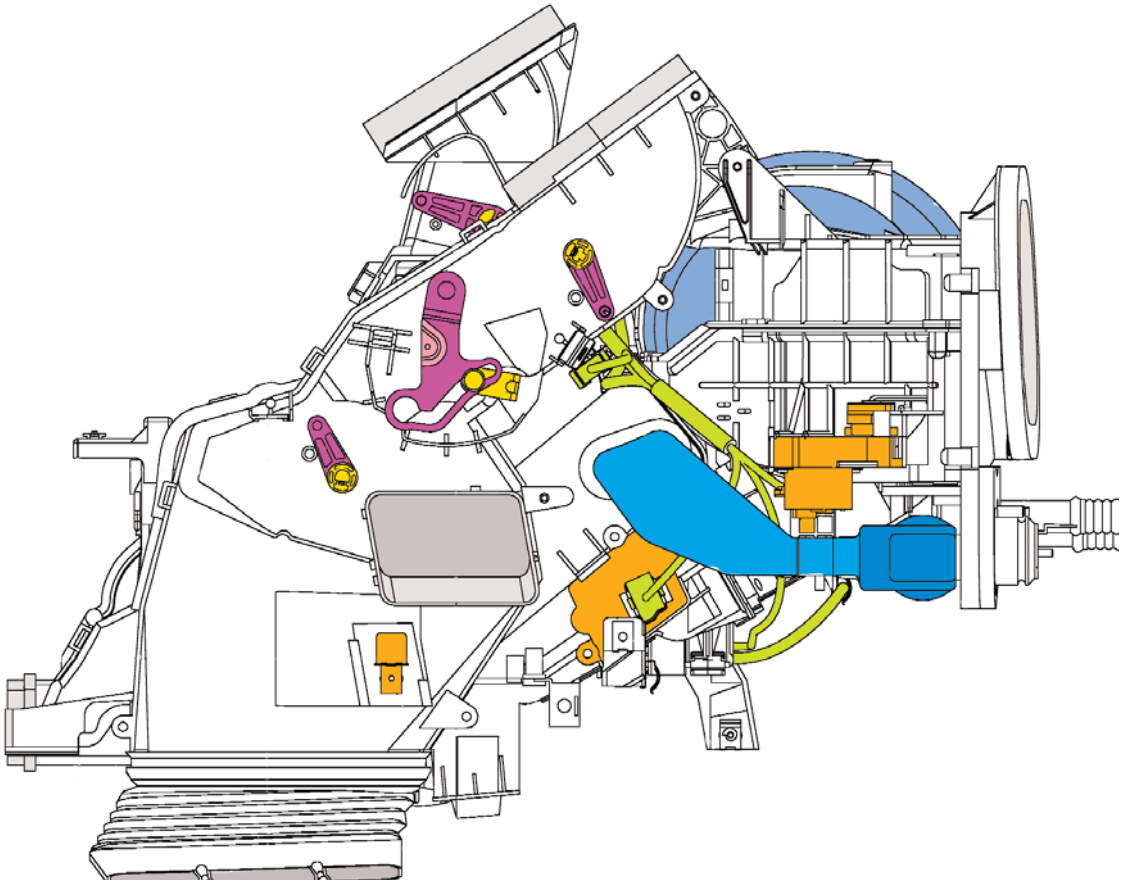
- IHKR heater/air conditioner unit with
  - 1 heat exchanger temperature sensor
  - 1 evaporator temperature sensor
  - 1 footwell temperature sensor
  - Blower motor
  - 1 stepper motor (high speed fresh/rcirc air)



IHKR Operation

IHKR system operation is as follows:

- Temperature Control - The desired interior temperature is set with the rotary knob on the control panel. Control of the interior temperature is carried out electronically by the control module's cycling of the water valve to regulate coolant flow through the heat exchanger.

- Air Distribution - Air distribution is set mechanically through the use of gear linkages and bowden cables. The air can be set for:

    - Footwell or blended between footwell/face vent or footwell and defrost
    - Defrost or blended between footwell/defrost or defrost/face vent
    - Face vent or blended between face vent/footwell or face vent/defrost

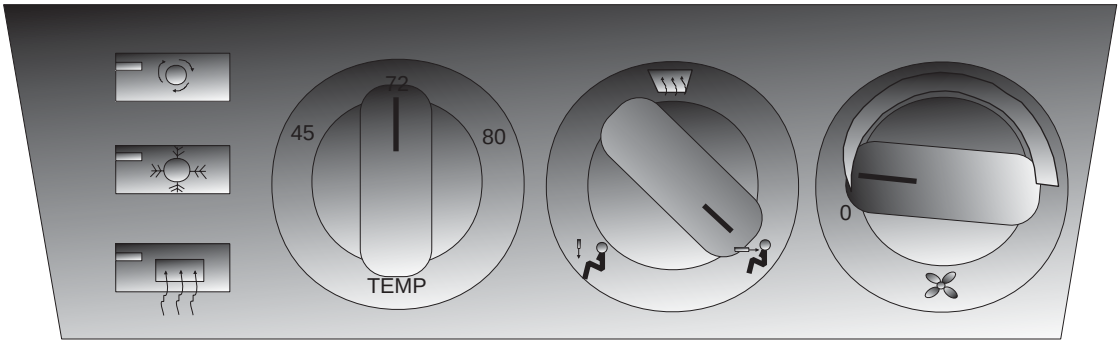
- Blower Control - Blower fan speed is controlled through a final stage with infinitely variable speed control.

  The push buttons on the control panel are used to:

- Switch between fresh air and recirculating air inlet modes

- Request for A/C activation

- Activation of the rear window defogger



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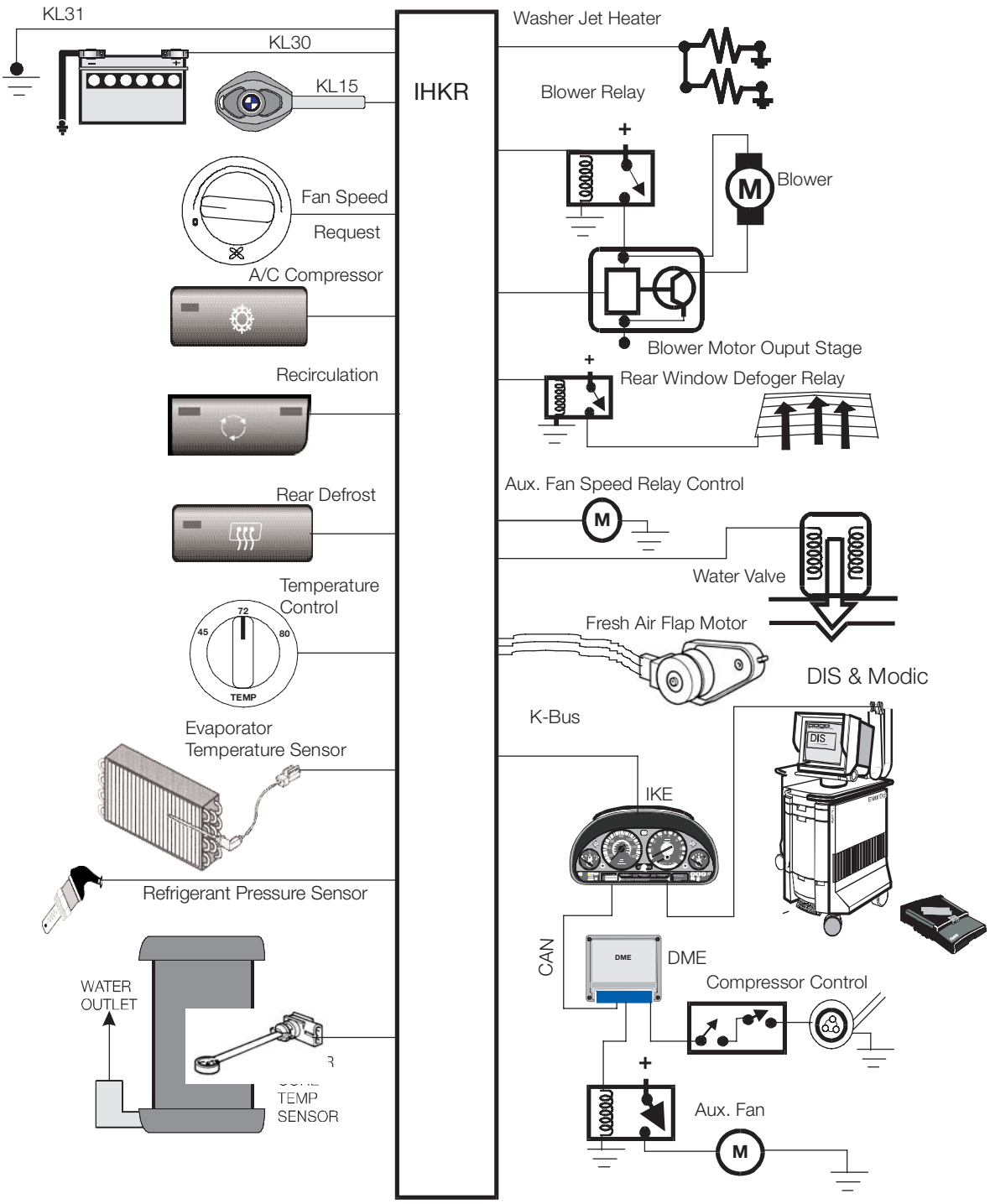
IHKR IPO



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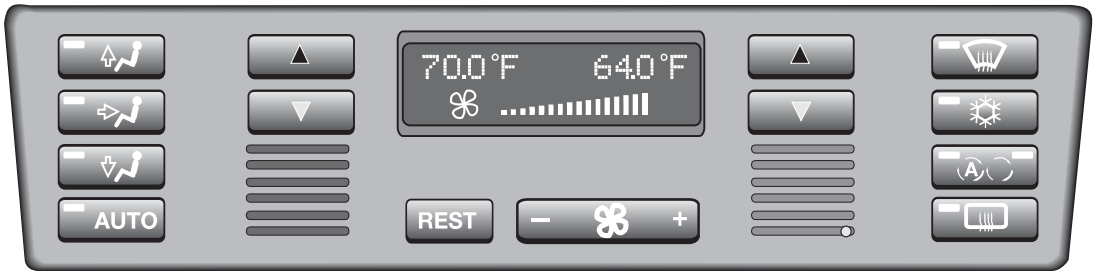
Climate Control System (IHKA)

The IHKA is standard equipment on the X5 with the M62 engine and optional equipment on the M54 version. The IHKA system is taken from the E39 sedan and includes all functions and features of the IHKA currently installed in the E39.

Features of the IHKA system include:

- Integrated control panel/module.
- Separate temperature control for the driver and front passenger.
- Air flap control through the use of bussed stepper motors.
- Automatic Recirculation Control (AUC).
- Recirculation air flap control from the MFL.
- “REST” function for residual heat when vehicle is stopped.
- Service station feature that closes the water valves when stopped to prevent hot water circulating into the heater cores.
- A/C compressor clutch activation through a final stage control.
- Center face vent stratification control through a bowden cable.
- Separate blower motor for rear passenger compartment



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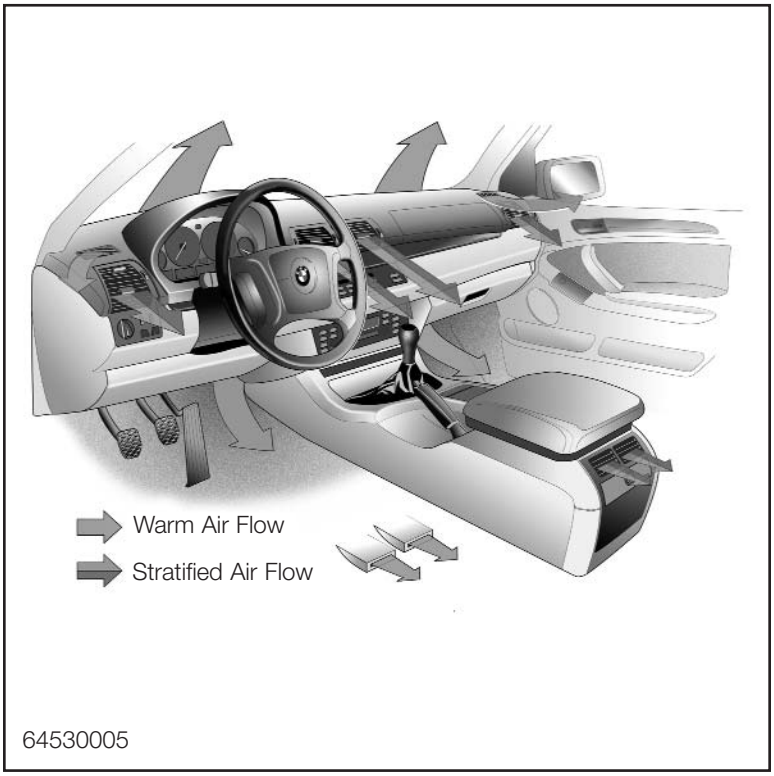
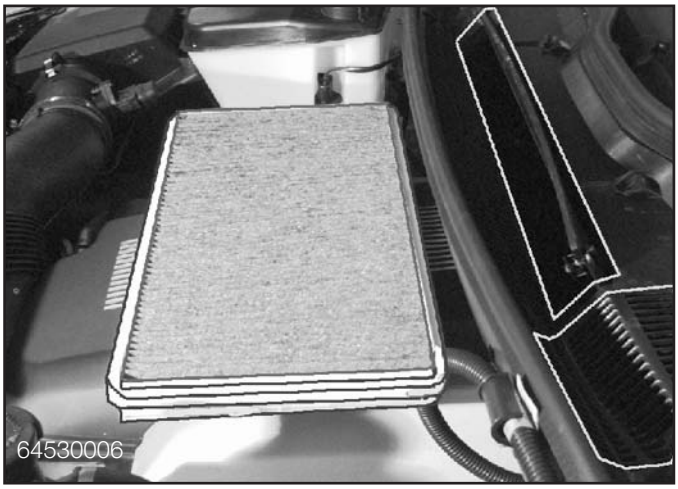
The rear blower motor is located below the center storage box behind the center air outlet grilles. The blower speed control is mounted in the panel below the outlets. Cool or stratified air is available at the center outlets.

IHKA Air Flow

The micro filter for the IHKA system is installed in the engine compartment in the center of the engine bulkhead.



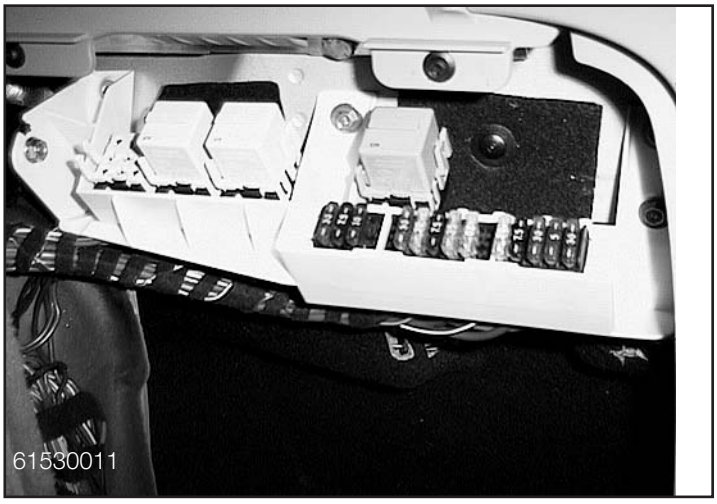


Cargo Area

The cargo area of the X5 offers 450 liters/15.9 cuft of space and has a load capacity of 440 pounds. The retractable, removable cargo cover is standard equipment. Storage compartments are located on the left and right sides in the rear.

The left side storage compartment contains the NAV computer when installed and the telephone transceiver and CD changer.

The right side storage compartment contains the rear power distribution fuse box as well as the sub-woofer for the stereo system. Mounted in front of the right side storage compartment are two 12 volt accessory power sockets.



Cargo Area

The sliding load floor is available as an option on the X5. It is mounted through two sliding bushing on two steel rails

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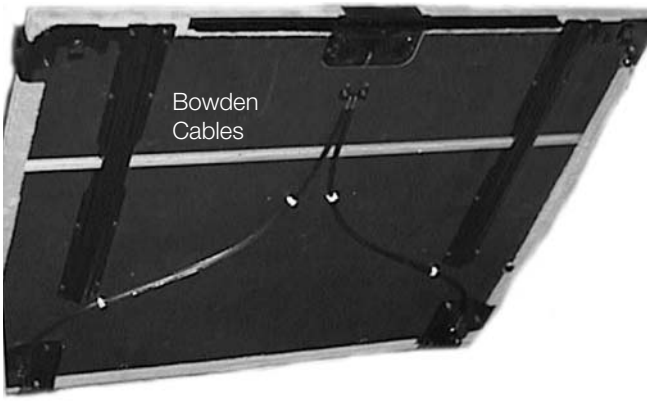
The load floor is held in position by the locking bowden cable mechanism that latches when closed to prevent the floor for sliding while the vehicle is moving. The load floor incorporates a shear point that will cause the floor to collapse upward in a rear collision.



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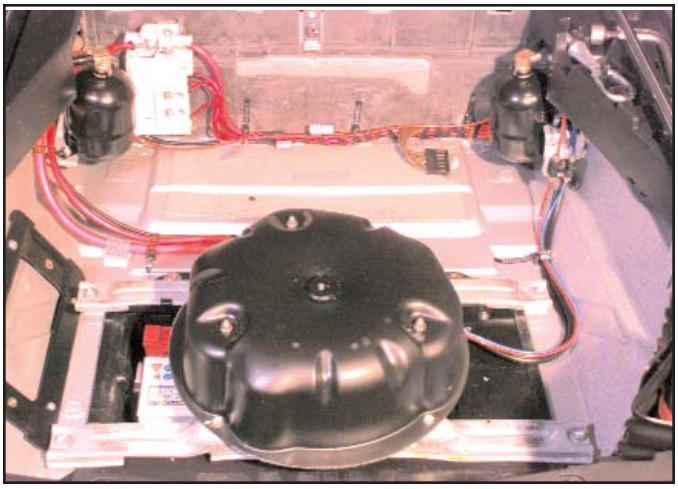
Cargo Area

The full size spare tire is mounted below the load floor with the LVA air supply system for the air springs located beneath the spare.

The battery is mounted below the LVA in a molded plastic battery box, along with the EHC control module and the PDC control module. If the optional trailer towing package is installed, the trailer module is also installed in the module carrier.



Tailgate

The tailgate on the X5 is two sections that open up and down. The upper section has a fixed bonded rear glass that incorporates the rear window wiper and motor assembly. Two gas strut pistons are used on the upper section for opening. An electric actuator is incorporated in the upper section with the micro switch for operation located between the two license plate lights. The actuator locks into the lower tailgate section when closed.

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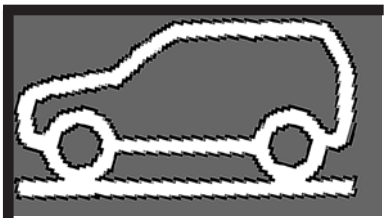


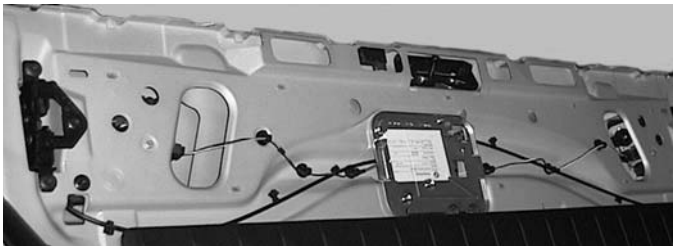
A micro-switch positioned in the center console switch panel is used to open the tail gate from inside the vehicle.

Operation of the upper tail gate is controlled from the GM which locks the operation of the gate when the vehicle speed is over 5 MPH. A dealer installed class three trailer hitch is available as an option with a towing capacity of 6000 pounds.


00530016

Tailgate

The lower tailgate section also uses an electric actuator for its operation. The actuator is positioned in the center of the tailgate and operates two latches though bowden cables. The latches are positioned on the left and right sides of the tailgate. Two springs are used to dampen the operation of the lower tailgate section.



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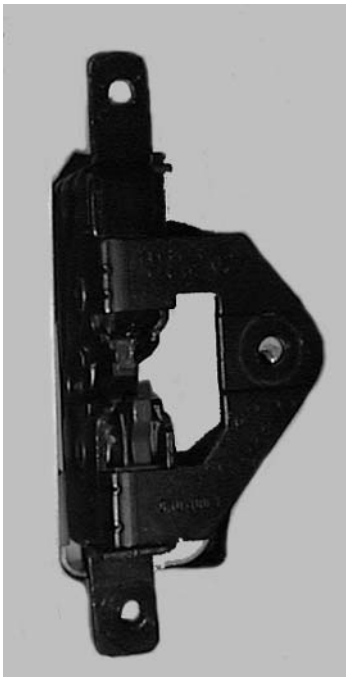

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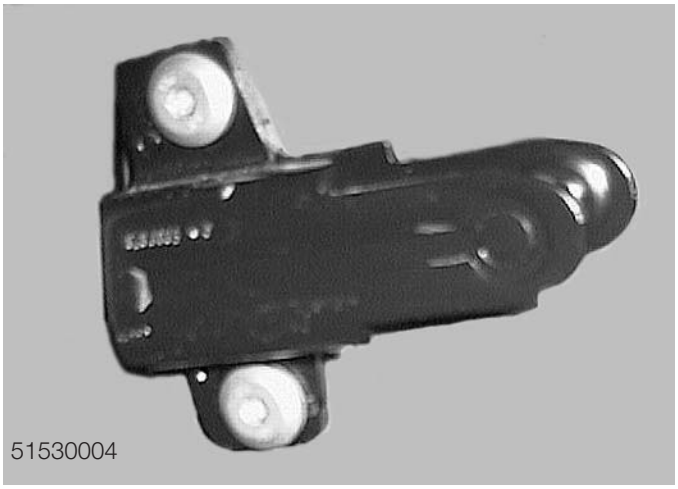
Adjustments of the rear tailgate are carried out at the tailgate body latch on the left and right sides.



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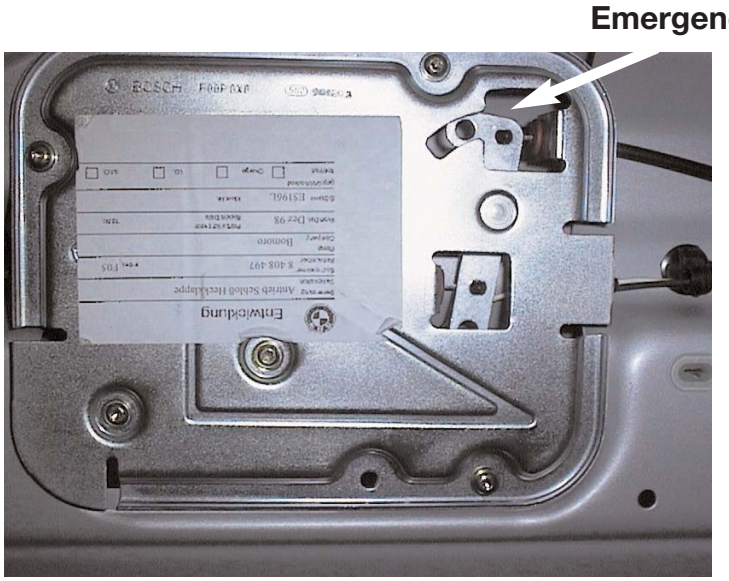
Tailgate (Emergency Opening)

Both sections of the tailgate incorporate emergency release mechanisms for opening the tailgate in the event of electrical or component failures.

The upper tailgate release is a plastic pull tab positioned on the right side of the inner trim cover. Pulling the release tab will mechanically release the upper actuator.

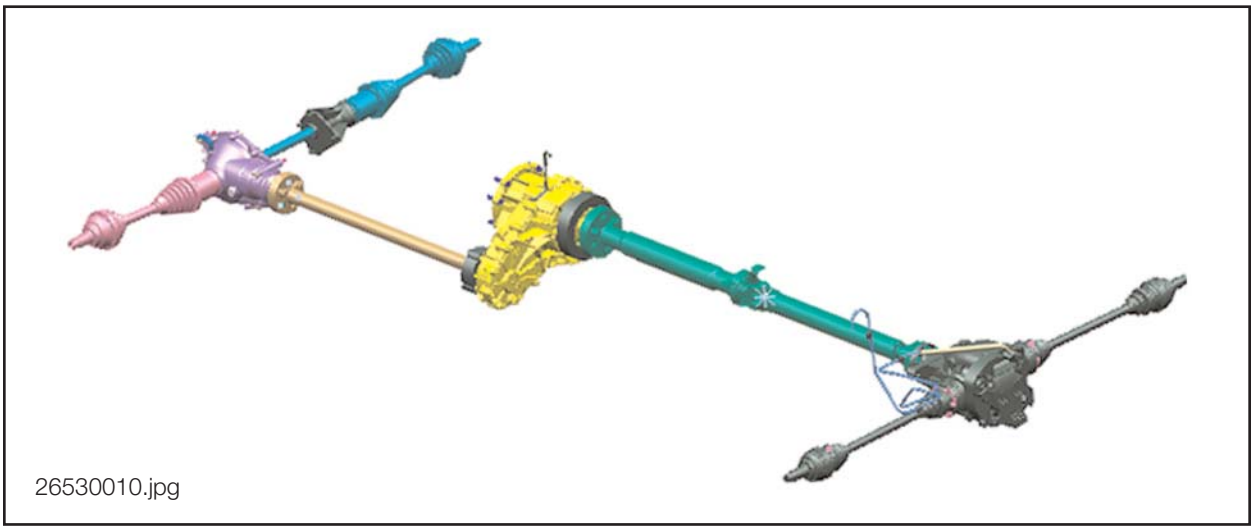
The lower tailgate emergency release is accessed by removing the trim cover on the tailgate section. With the gate closed, only the top section will be able to be loosened. The mechanical release is actuated by inserting a small screwdriver into the opening and pressing the latch to the left.



Drivetrain

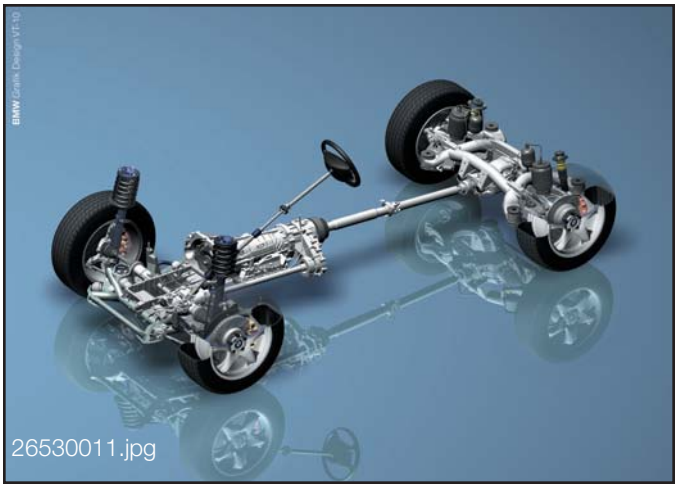
The transfer case, driveshafts, final drives and half shafts make up the drivetrain assembly. The transfer case is always mounted in the same position on the X5. This applies to other markets and future models that will utilize different transmissions for different engine configurations. With these models, the transmission tail shafts will be modified to match up with the transfer case.

The rear driveshaft is a two piece unit using a center bearing, while the front drive shaft is a single piece that is splined to the transfer case and bolted to the front differential.



26530010.jpg

The breather vents for both differentials and the transfer case are mounted higher up on the chassis to prevent water from entering if the vehicle is driven off road through water. The front breather passes up into the engine compartment and is mounted under the left side ignition coil cover. The rear breather passes along the under side of the body and is mounted behind the left side wheel arch cover. The breather vent for the transfer case is mounted up high in the driveshaft tunnel.



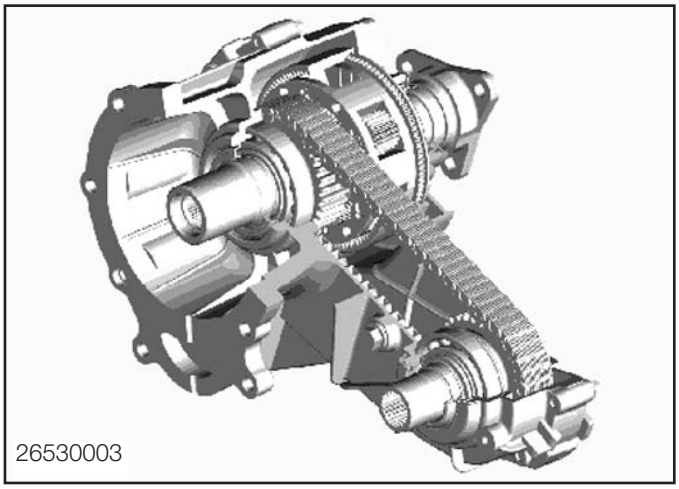
26530011.jpg

Drivetrain-Transfer Case

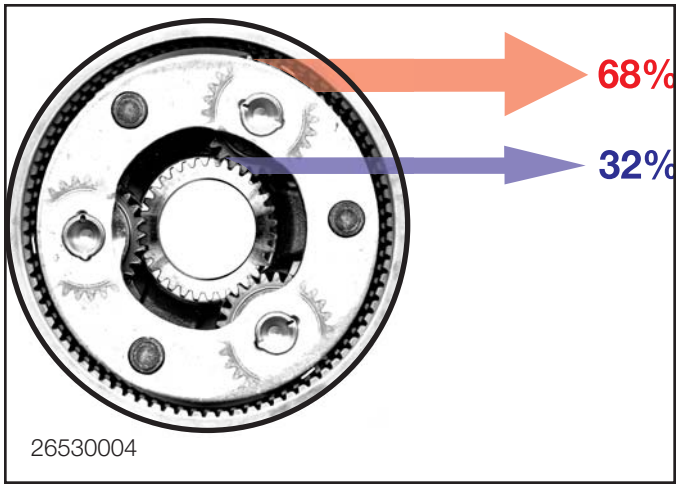
The transfer case is manufactured by New Process Gear Division of New Venture Gear Company. It is identified as model NV 125.

It incorporates a planetary gear set and chain to provide the torque split and all wheel drive. The output torque of the transmission is applied to the planetary carrier of the gear set. The rear drive shaft is connected to the annulus gear and the front drive shaft is connected to the sun gear through the chain drive.

As the output shaft of the transmission turns, the planetary carrier rotates, causing the planetary gears to drive the sun gear and annulus gear.


26530003

A torque split of 68% rear/ 32% front is provided through the gearing of the planetary set.

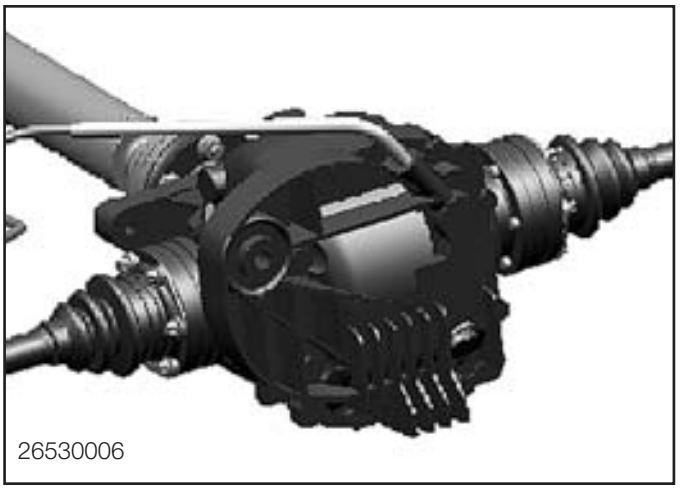


26530004

Drivetrain-Final Drives

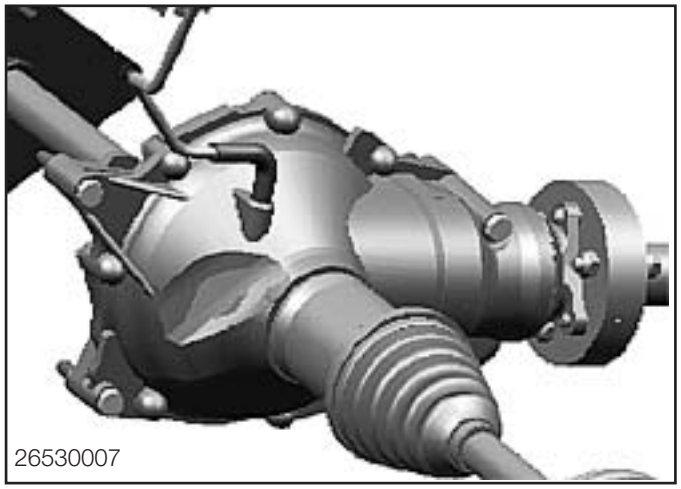
The final drives for the front and rear axles are conventional differentials. The DSC system provides anti-spin/slip control for both the front and rear axles on the X5.

The rear differential is the HAG 188K (compact) unit with a ratio of 3.64 : 1



26530006

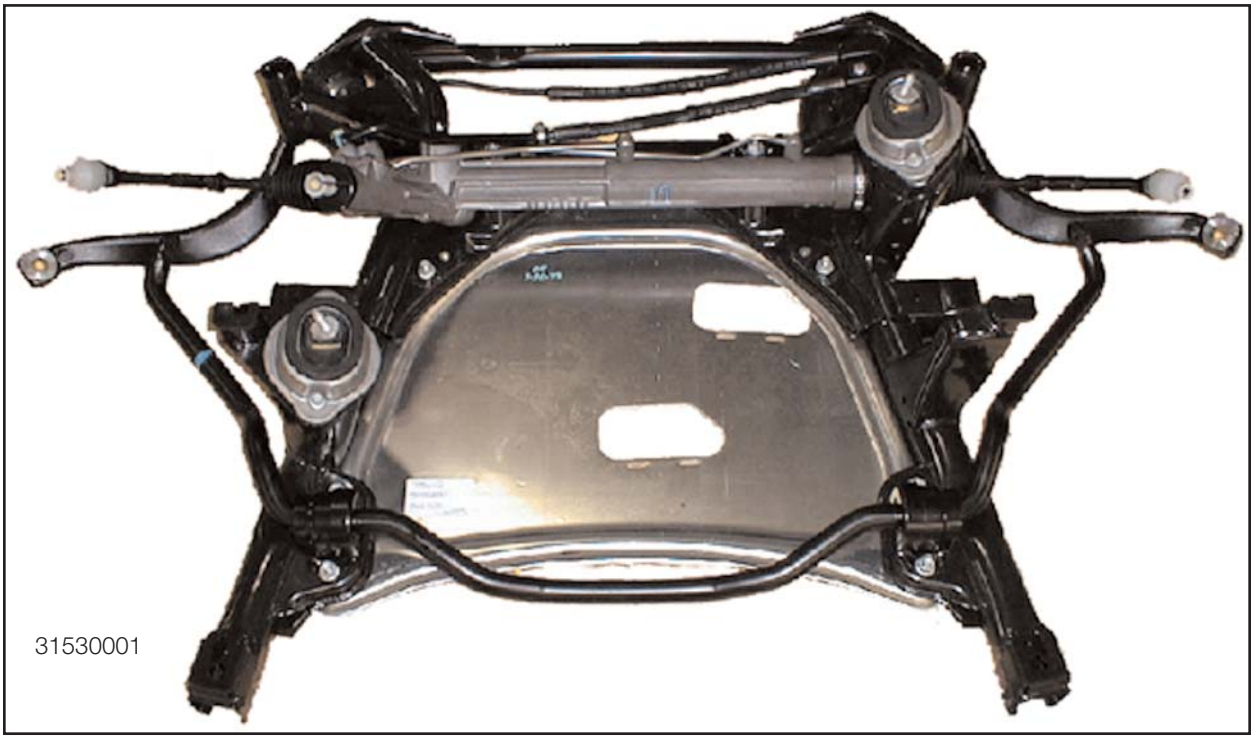
The front differential is the VAG 174 unit with a ratio of 3.64 : 1.



26530007

Front Suspension

The front suspension design is taken from the E38/E39 double pivot system. The components are larger in size and made from all steel for the expected harder use that the X5 suspension will receive. This includes the sub-frame which is also larger in size and supported by two hydraulic mounts for vibration absorbion. The front suspension carrier incorporates an aluminum stiffening plate that is bolted to the carrier. It adds to the front axle kinematics by reducing flex in the front suspension. It also provides protection for the oil pan and front end components when off-road and improves the Cd by providing a smooth surface for air flow under the vehicle.



31530001

Front Axle Technical Data
TRACK: 1576mm
TOE-IN: 18’ +/-10’
CAMBER: -12’ +/- 20’
S.A.I: 12 Degree’s 48 Feet
CASTER: 7 Degree’s 8 Feet

Front Suspension Alignment

The front suspension is adjustable for toe-in and camber. The camber correction is limited to +/- 12 minutes through the elongated slots at the top of the strut towers.


32530000

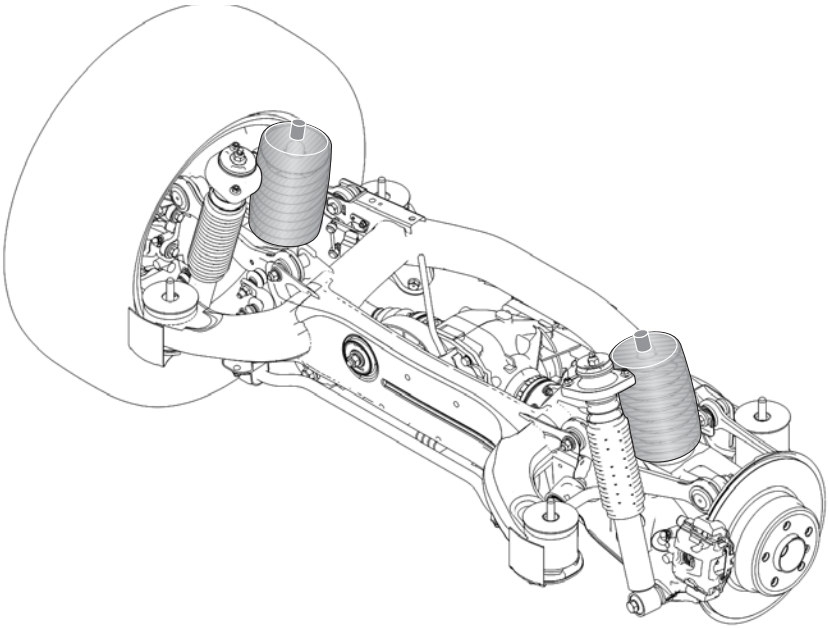
The locating pin at the strut mount is pressed in place and must be pried out for removal in order to make any camber corrections.


32530001

Rear Suspension

The rear suspension is the “intragal” multi-link design taken from the E38/E39 vehicles. Several components AER made from aluminum to erduce the unsprung weight. The X5 with the M62TU engine uses the EHC (air spring) suspension system. The EHC functions the same as the E39 Sport Wagon with only minor differences to the components and lay-out of the system. The X5 with the M54 engine will use standard springs in the rear with the EHC system as an option. The rear struts on the X5 are mounted to the body instead of the sub-frame.

The rear axle sub-frame is mounted to the body through four bushings (larger than E38) for increased load and comfort. The rear differential is mounted through three rubber bushings two in the front and one hydromount in the rear. The wheel bearings are similar to the E39 but incorporate different seals - designed for off-road use.



Rear Axle Technical Data
Track: 1576mm Toe In: 18 Feet Camber 1 Degree 50 Feet

New special tools are available for adjusting the rear suspension due to the limited space.

Rear Suspension Alignment

As with other BMW multi-link suspensions, the X5 rear suspension is adjustable for Camber and Toe-in. Due to the limited space, special tools have been produced for aligning the rear suspension.

The Camber is adjusted through the eccentric bushings at the upper control link arm.

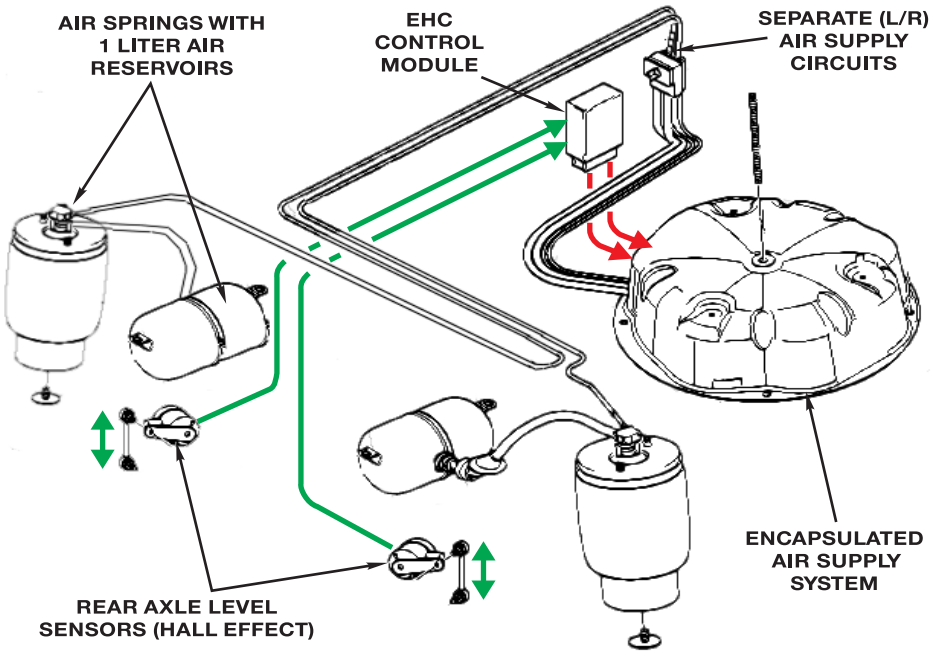
The toe-in is adjusted at the lower control arm mount.

Overview of EHC Control System

The control philosophy of EHC is to "Initiate a control sequence only when necessary". The system offers the following advantages:

- The control system operates independently from the vehicle's engine (no engine driven hydraulic pump system as per previous self leveling systems).
- Individual control of the rear wheels is possible
- An uneven load is identified and compensated for
- Uneven road surfaces are identified and not compensated for
- Automatic control is interrupted when cornering
- The system is diagnosable using the DIS or MoDiC

The air suspension system consists of the following components:



37530000

EHC System Components

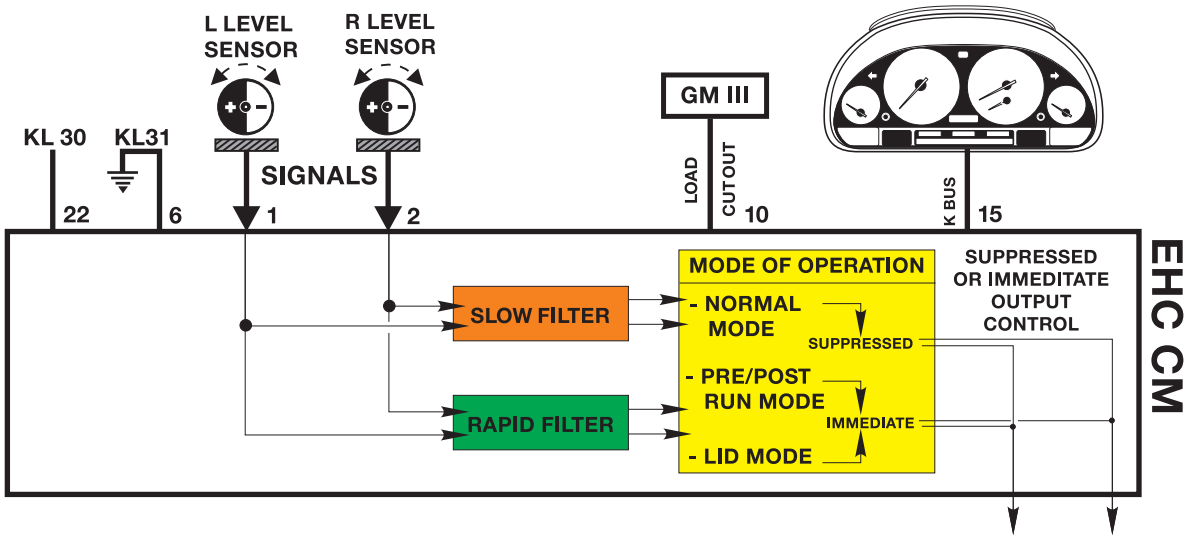
Control Module

The Control Module is mounted in the module carrier box in the luggage compartment on the right side. It contains the processing electronics and final stages for operation of the EHC system.

The control module receives the following inputs for its processing functions:

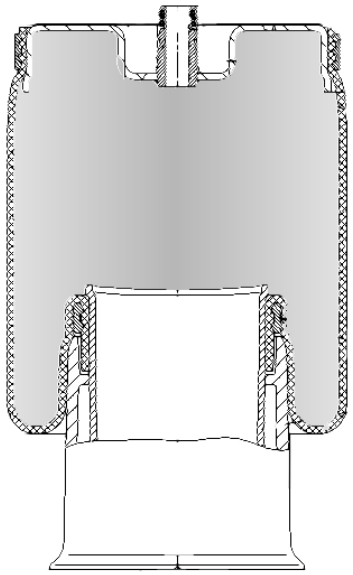
- KL 30 & 31 (Power/Ground)
- KL 15
- Left & Right Ride Height Sensors
- K Bus for;
  - Vehicle speed
  - Engine running
  - Door/tailgate - open/closed

The control module incorporates two filters (slow/rapid) for processing the input signals from the ride height sensors. Depending on the operating mode, either the slow or rapid filter is used to check the need for a regulating sequence.
The slow filter is used during the normal operation mode to prevent normal suspension travel from causing the system to make adjustments.



The rapid filter is used during the pre-run and tailgate (LID) modes to ensure that the suspension is adjusted quickly while the vehicle is being loaded or checked prior to operation.

Air Springs

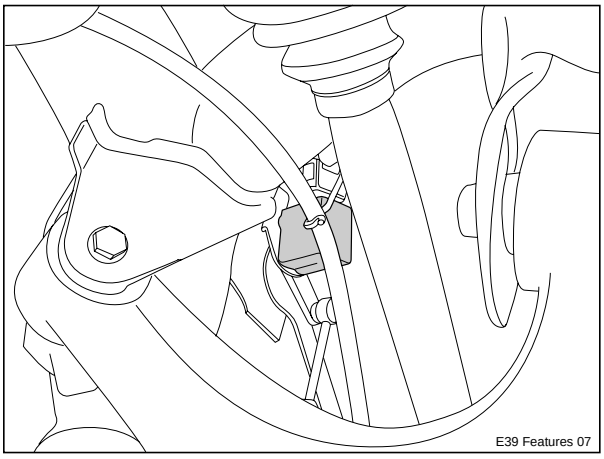


The air spring is made from a flexible rubber material. It forms an air tight cavity which provides the calculated spring rate required for the sport wagon.

As the spring compresses downward the bottom edge of the rubber material rolls along the vertical surface of the base mount cylinder.

Air is added or removed from the air spring through its top port. The top port of each spring is connected to a reservoir and the air supply pipes. The reservoirs are required to hold additional air due to the compact design of the springs.

Rear Axle Level Sensors



Hall effect sensors are mounted on the left and right sides of the rear suspension for ride height detection. They are pivoted by a coupling rod through the rear axle swing arms.

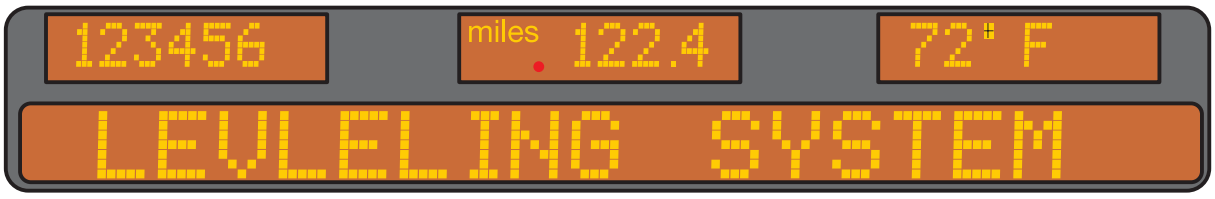
The hall sensors produce a varying voltage input to the control module as the suspension height changes.

If the vehicle is equipped with Xenon headlights the right side sensor contains an additional sensor for the automatic headlight level adjustment system.

Warning Display

If the system is faulted and off-line or set in the transport mode, the following is displayed:

High Cluster: A message is posted in the high cluster matrix display.

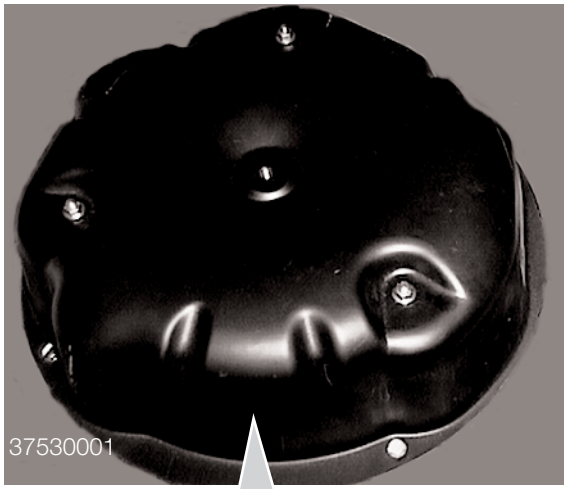


Air Supply System (LVA)

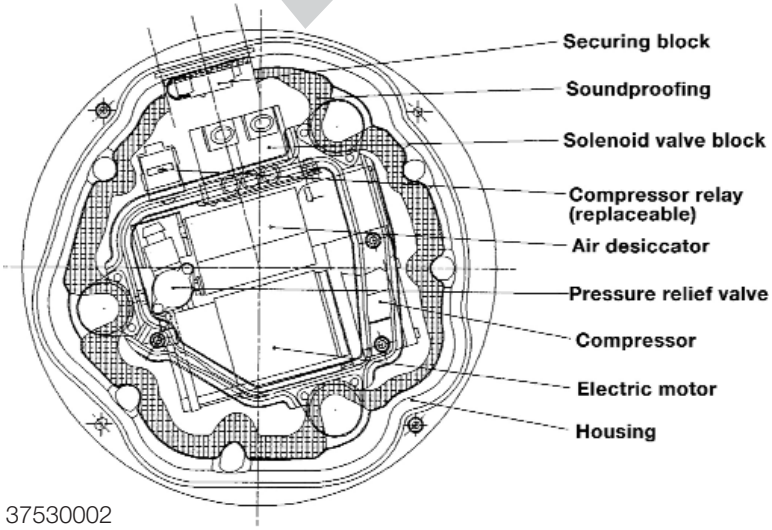
The air supply system is identified as the LVA in the diagnosis program and in the repair manual. It is mounted in the spare tire well compartment. The components are housed in a sound deadening carrier, through rubber bushings, to prevent operating noises from being transmitted through the vehicle's interior.

With the exception of the compressor relay, individual replacement parts for the air supply system are not available. If diagnosis determines a defect in any of the other air system components, complete replacement is necessary.

The air supply system consists of the following components:


37530001

- Compressor assembly with;
  - Piston compressor
  - Electric motor
  - Air dryer (desiccator)
  - Pressure relief solenoid valve
  - Pressure maintenance valve
  - Check valves
- Compressor Relay (Replaceable)
- Solenoid Valve Block (2 - two way valves)



37530002

Air Supply System (LVA) Operation

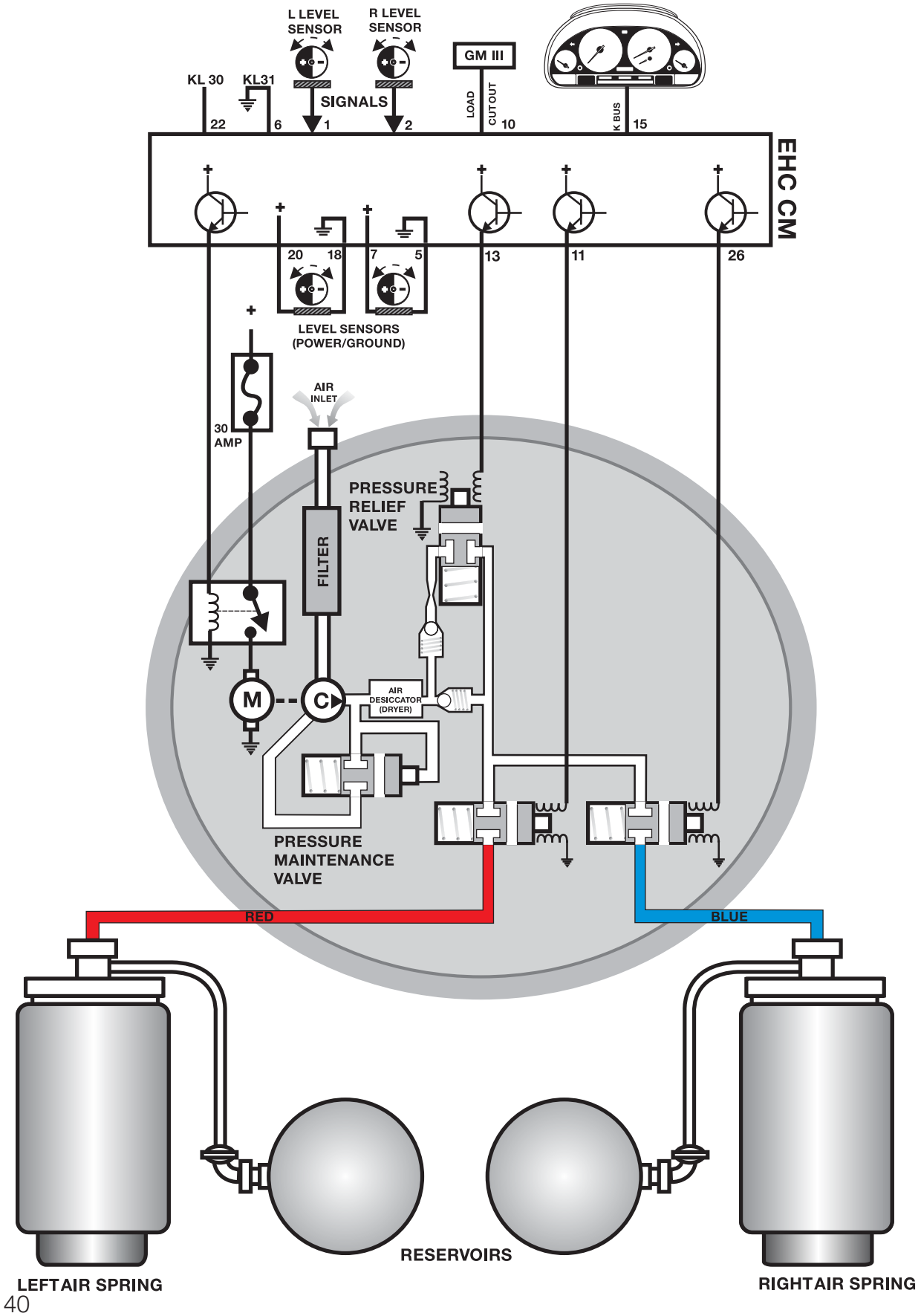
The single stage piston compressor produces a maximum pressure of 13.5 Bar. The compressor is maintenance free - provided it is used in a dust free environment. This includes the compressor's intake air filter.

The compressor is driven by a DC motor that is controlled by the compressor relay through the control module.

When the compressor is activated, the pressure builds up to a working pressure of 11.4 Bar (+0.8/-1.5 Bar). This is controlled through the pressure maintenance valve. The air under pressure is fed through the dryer and check valve to the solenoid valve block for the air springs.

There is one solenoid valve in the valve block for each air strut. This allows the system to compensate for uneven loads in the vehicle and maintain the vehicles ride height at all times.

Pressure is drained through the left or right solenoid valve (energized open) the pressure relief solenoid valve, restricter, check valve and dryer back to the inlet side of the compressor pump.


L LEVEL SENSOR
R LEVEL SENSOR
GM III
KL 30
KL31
SIGNALS
LOAD
CUTOUT
K BUS
22
6
1
2
10
15
EHC CM
20
18
7
5
13
11
26
LEVEL SENSORS (POWER/GROUND)
AIR INLET
30 AMP
PRESSURE RELIEF VALVE
FILTER
M
C
AIR DESICCATOR (DRYER)
PRESSURE MAINTENANCE VALVE
RED
BLUE
RESERVOIRS
LEFT AIR SPRING
RIGHT AIR SPRING

EHC System Operation

A fully functional EHC system is controlled by one of three different modes of operation. The operation mode is selected by the control module based on current conditions provided by the monitored input signals. The main modes of operation are:

- **Pre-Run/Post-Run Mode**
- **Normal Mode**
- **Tailgate Mode**

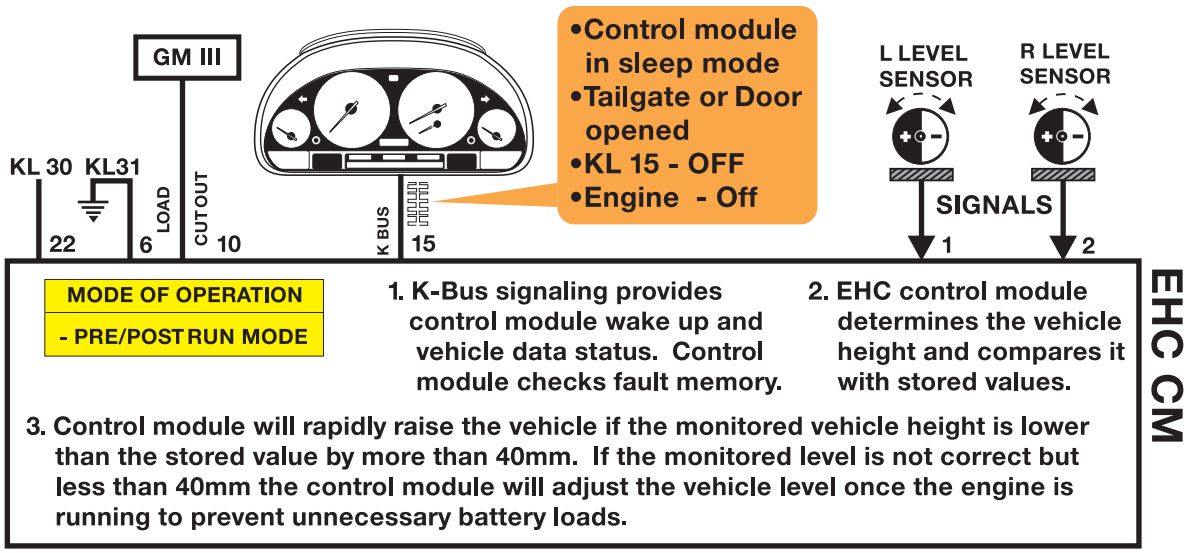
Two special operating modes are also included in the control module programming.

- **New/replacement mode** (pre ZCS encoded). This mode provides basic operation.
- **Transport Mode** - Transport mode is set at the factory and raises the vehicle 30mm to prevent vehicle damage during transportation. It must be deactivated with the DIS/MoDiC prior to customer delivery.

Pre-Run/Post-Run Mode

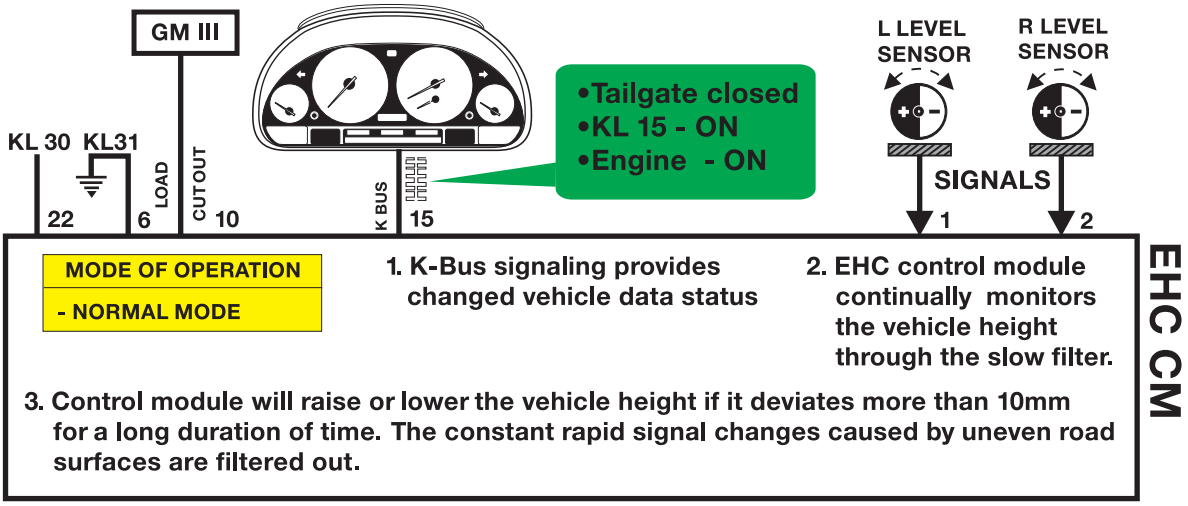
The Pre-Run mode is activated when the vehicle is parked and the control module is in the sleep mode. Opening a door or the tailgate initiates a system wake up and the control module comes on-line.

The control module performs a self-check of the control electronics and sensors. If no fault is found, the system will check the ride height and institute a rapid regulation if the height varies by more than 40mm.



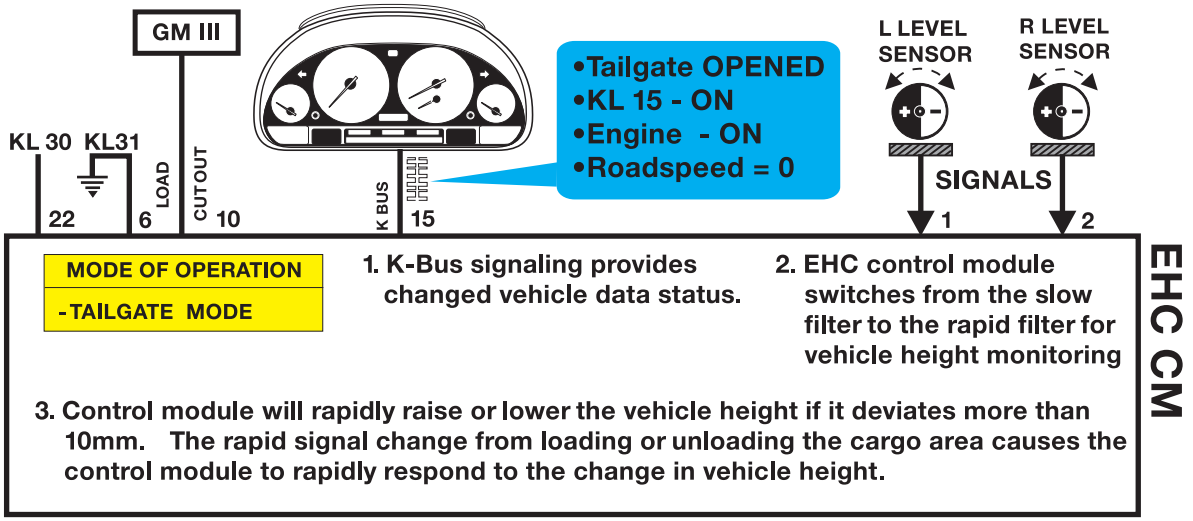
Normal Operation Mode

Once the rear lid is closed, KL 15 switched ON and the engine started, the system switches into the normal operation mode. In the normal mode, the control module will constantly monitor the input signals from the ride height sensors and will activate a correction if the ride height deviates by at least 10mm.



Tailgate Operating Mode

The tailgate operating mode is activated if the gate is opened with KL - 15 On and the engine running. The difference between this mode and the normal operating mode is the response time is rapid instead of slow .



Special Operation Mode

- Assembly Line Mode (New control module)

  The assembly line mode refers to control module manufacturing. New control modules are stored in a deactivated state. The control programming is not active and must first be ZCS encoded.

  After installing a replacement control module, it must be coded using the DIS or MoDiC. The instrument cluster fault display will remain illuminated until the control module is coded.

Control Interrupts

Cornering

To prevent unnecessary suspension adjustments while driving through corners, a “control interrupt” is built into the system. Above 30MPH the control module monitors the left/right ride height sensors for a difference of 30mm. Exceeding this difference will put the system into a control interrupt and no adjustment will take place. The control interrupt last for a duration of 5 minutes.

Vehicle Lifting

The ride height control is interrupted when the vehicle is raised on a lift or with a jack. The system monitors the ride height sensor inputs and when the height limit of 90 mm is exceeded, the control is switched OFF until the vehicle is lowered again.

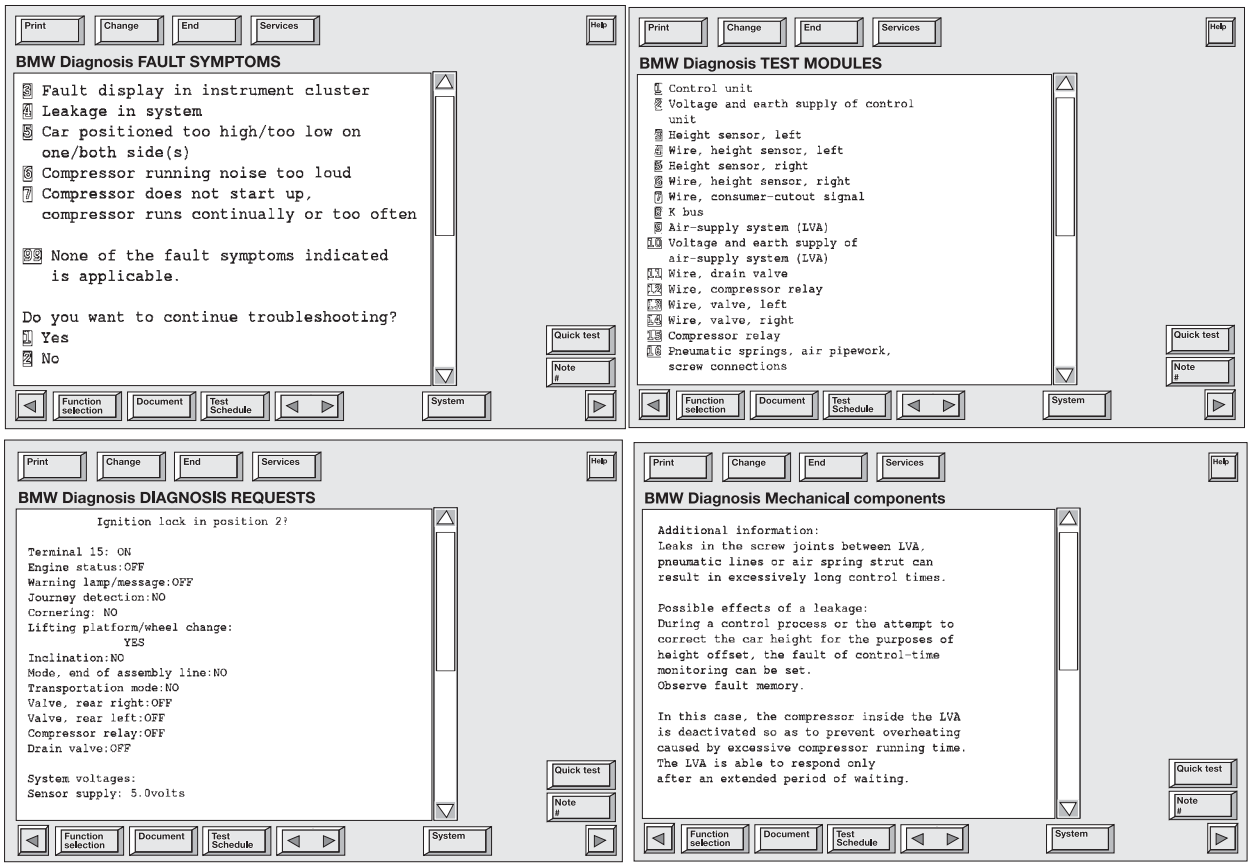
EHC Service Information

Diagnosis / Coding

- The EHC control module is connected to the diagnostic link. The EHC control module activates the fault display in the instrument cluster to alert the operator of the off-line status of the system. The EHC control module stores up to three electrical/electronic faults.

- Diagnosis/troubleshooting of EHC is carried out using the fault symptom troubleshooting program of the MoDiC or DIS. The EHC system has an extensive diagnosis program.

- Replacement control modules are shipped in the factory mode. The control modules must be ZCS encoded using the DIS or MoDiC to activate the operating parameters.



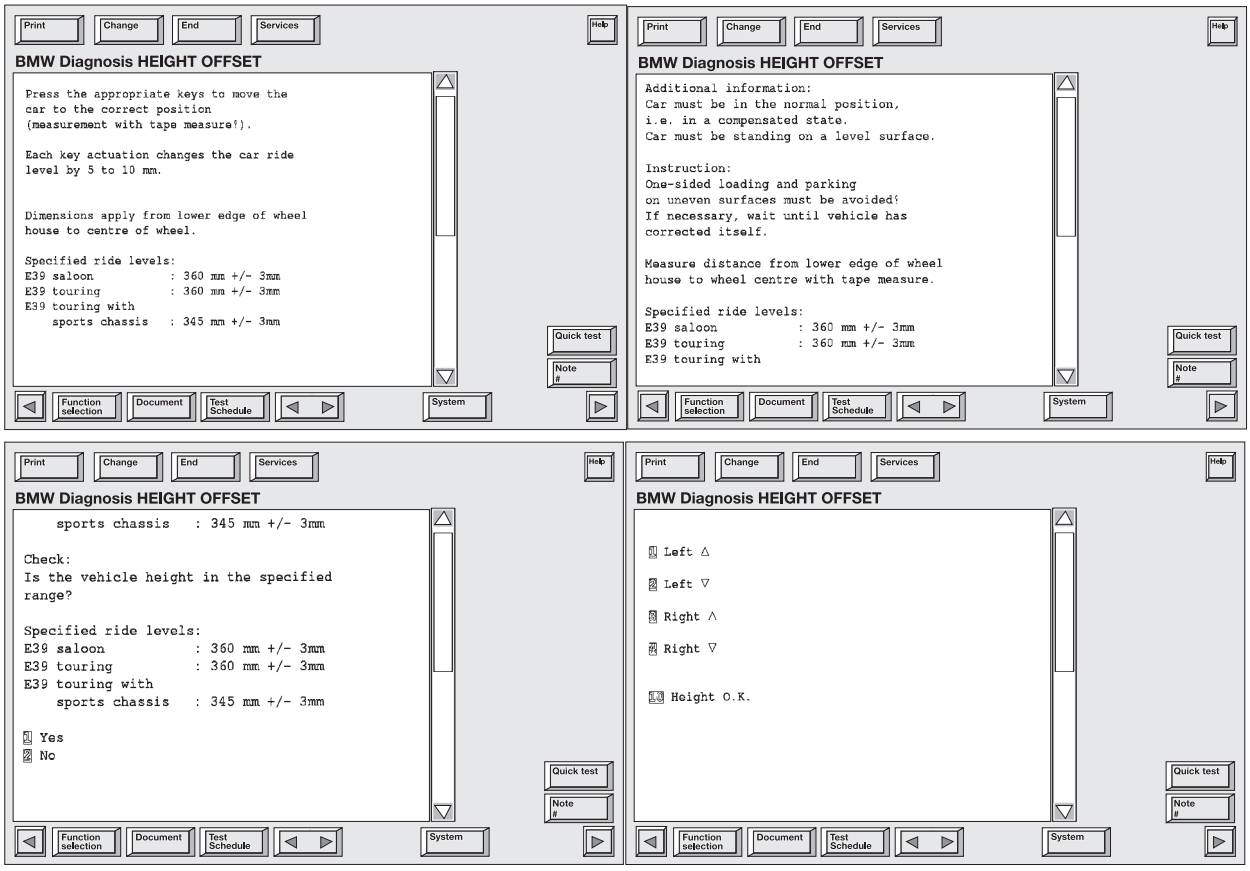
DIS/Modic Service Funnction Program

The Service Functions program of the DIS/MoDiC provides the Transport Mode activation/deactivation and Ride Height Offset functions (see next page).

Once the transport mode has been released, or if the system requires left to right side height adjustment, the ride height "OFFSET" must be carried out to ensure that the vehicles suspension has a base ride height level starting point.

The "HEIGHT OFFSET" is adjusted using the DIS or MoDiC. The procedure is as follows:

- Place the vehicle on a level surface unloaded.
- Access the Height Offset program in the service function menu.
- Measure the base ride height from the lower edge of the wheel housing to the center of the wheel hub.
- Check measured height against the specifications listed
- Use the DIS/MoDiC to correct the ride height if the value differs from the listed specification.



Two Axle Air Suspension

Purpose of the System

The two axle air suspension system (EHC2) offers advantages over the single-axle air suspension with respect to ride comfort and off-road capability.
Lowering the entire body makes it easier to enter, exit, load and unload the vehicle.
The vehicle's off-road capability was improved by providing the possibility for increasing the ground clearance of the body.
The driver can now choose between three different ride levels which can be set with a rocker switch, as required. Automatic ride-height control for payload compensation and automatic inclination compensation continue to be fitted.

Deficits of the old system

The automatic payload compensation facility for the single-axle air suspension did not permit driver control. The driver could not actively control the system to make it easier to enter and exit or load the vehicle.
Ride level was compensated via the rear axle only.

Advantages of the new system

The new system allows the ride-height control system to be controlled actively by the driver.
The twin axle air suspension allows both axles to be lowered evenly and in parallel.
As a result, it is easier for the occupants to enter, exit, load and unload the vehicle.

History

BMW previously supplied ride-height control systems as both optional equipment and, in part, as standard equipment on the 7 Series - E23/E32(not in the US market), 6 Series - E24 (L6/M6) and 5 Series - E28 (M5). On the E39, the load of the complete rear axle was born for the first time by air suspension in combination with the optional ride height control system. The system was controlled automatically under all operation conditions, and there was no possibility for driver intervention on the X5, the rear axle previously had single axle air suspension only. The air supply unit and the control unit were adopted from the E39. The air springs were adapted to the X5.

There is a standard version and a sports version.

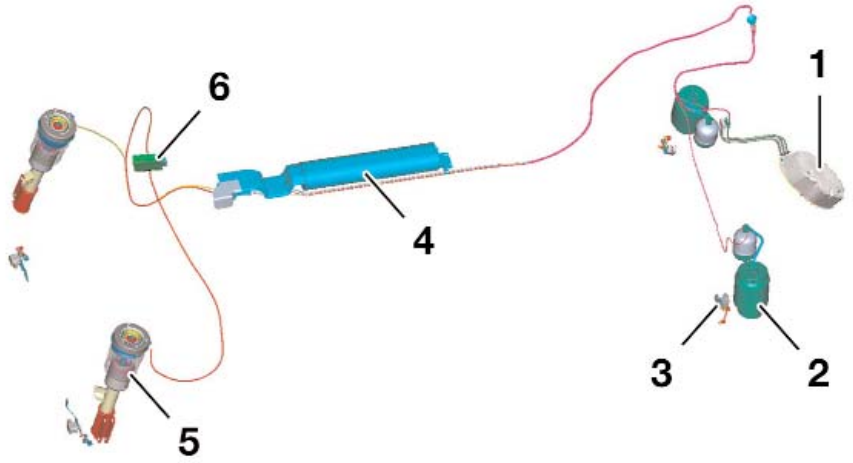
The ride-height control system (EHC) was supplied as standard in combination with the M62 engine and is available as an optional extra in combination with the M54 engine.

EHC2 is optional on both the M62 and M54 versions of the X5 and not available on the 4.6is X5.

System components

The X5 Two Axle Air Suspension System (EHC2) utilizes the air supply unit from EHC mounted in the luggage compartment, with the following components added or modified:

- Air Supply Unit (with redesigned compressor and drier)
- Pressure Accumulator
- Valve Unit
- Ride Height Sensor
- Air Suspension Strut
- Control Unit
- Switch Assembly



1. Air Supply Unit
2. Rear Axle Air Bellows
3. Ride Height Sensors
4. Pressure Accumulator/ Valve Unit
5. Front Axle Air Bellows
6. Control Unit

Pneumatic System of EHC2

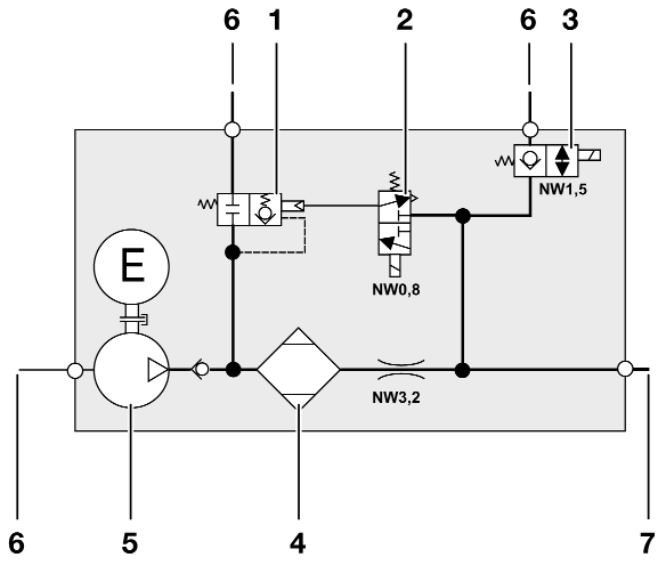
Air Supply Unit

As on vehicles with single axle air suspension, the air supply unit is located in the luggage compartment under the spare wheel. As with the single axle air suspension, the auxiliary tanks for the rear air spring bellows are located in the luggage compartment.

The air supply unit is configured similarly to the single axle air supply unit for the ride-height control system of the E39, which is currently in production.

The functions are implemented by activating a compressor and various valves in the air supply unit and on the air accumulator valve unit.

The maximum pressure of the air supply unit is 21 bar.



1. Pneumatic Drain Valve
2. Electric Pilot Control Valve
3. High Pressure Vent Valve
4. Air Drier
5. Compressor
6. Sintered filter
7. To Pressure Accumulator/Valve Unit

NW Size of opening/tubing in mm.

Air Supply Unit

Pneumatic Drain Valve

The Pneumatic Drain Valve is activated pneumatically by pressure from the control valve. This causes the drain valve to open allowing the pressure supply line to vent to atmosphere. This design allows for large air volumes to be discharged quickly and eliminates the need for a solenoid valve with high current consumption.
The 21 bar pressure limiting valve is integrated in the drain valve.

Electric Pressure Relief Valve

The electrically activated pressure relief valve controls normal system pressure. The control valve performs this function in conjunction with the drain valve.

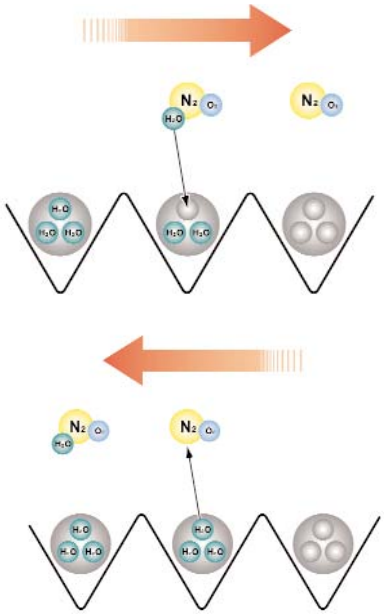
HIgh Pressure Vent Valve

The High Pressure Vent Valve serves as a comfort valve and is used to release system pressure after the accumulator has closed and the compressor is still running. When the high pressure vent valve has opened the compressor can be stopped quietly.

Air Drier

In the air drier, the air which is drawn in passes over a water absorptive filter material in the form of filter nodules which extract moisture from the air. As long as the air contains more moisture than the filter material, the individual nodules absorb and accumulate the moisture. When the air flows back, it is drier than the filter material, with the result that the air is re-humidified and the moisture is discharged into the open air. The maximum water storage capacity of the filter is 30 g.

Compressor with Drier



Top: Air Drying
Bottom: Dissipation of water to air

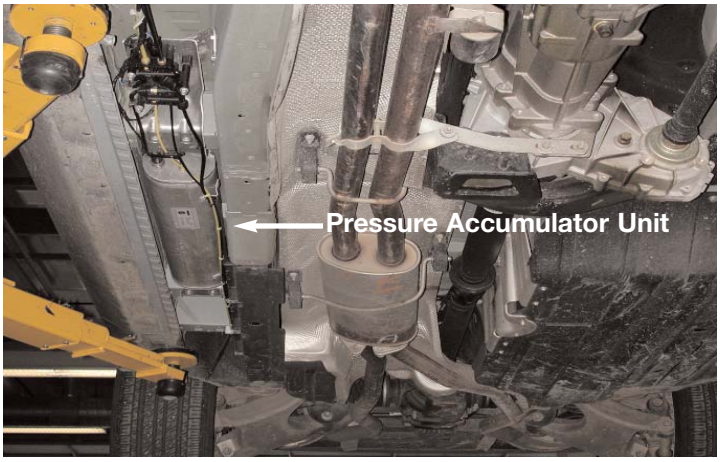
Compressor

Compressor operation is the same as in EHC with the following technical improvements:

- Addition of a temperature sensor (Located on the compressor cylinder head) Temperature sensor switches off the compressor at temperatures above 110°C.
- Extended compressor ON time (180 seconds)
- Redesigned air drier to compensate for additional air volume.

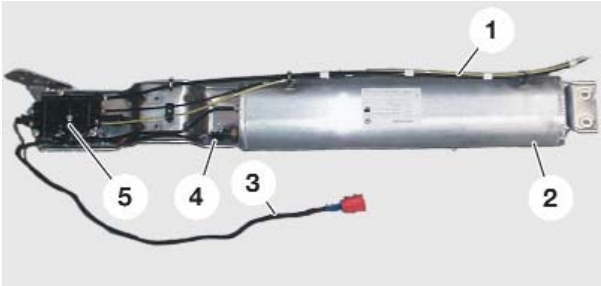
Pressure Accumulator

The twin axle air suspension system now features a pressure accumulator which forms an air accumulator valve unit in combination with the valve. The air accumulator valve unit is located beneath the vehicle floorpan in the right-hand sill area.

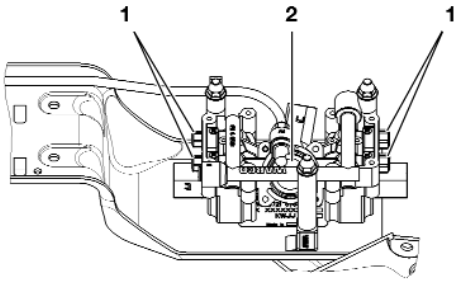


Pressure Accumulator Unit which includes:
Pressure Accumulator
Pressure Sensor
Valve Unit

The pressure accumulator decreases the load on the compressor and significantly reduces the time required for large changes in ride height.
The EHC 2 control module monitors system pressure via a pressure sensor mounted on the accumulator. Normal system pressure is 15.7 +/- 0.7 bar. Minimum system pressure is 9 bar.
The pressure accumulator's charge is sufficient to fill the four suspension struts once from the Access position to the normal position and compensate for vehicle load up to maximum gross weight.



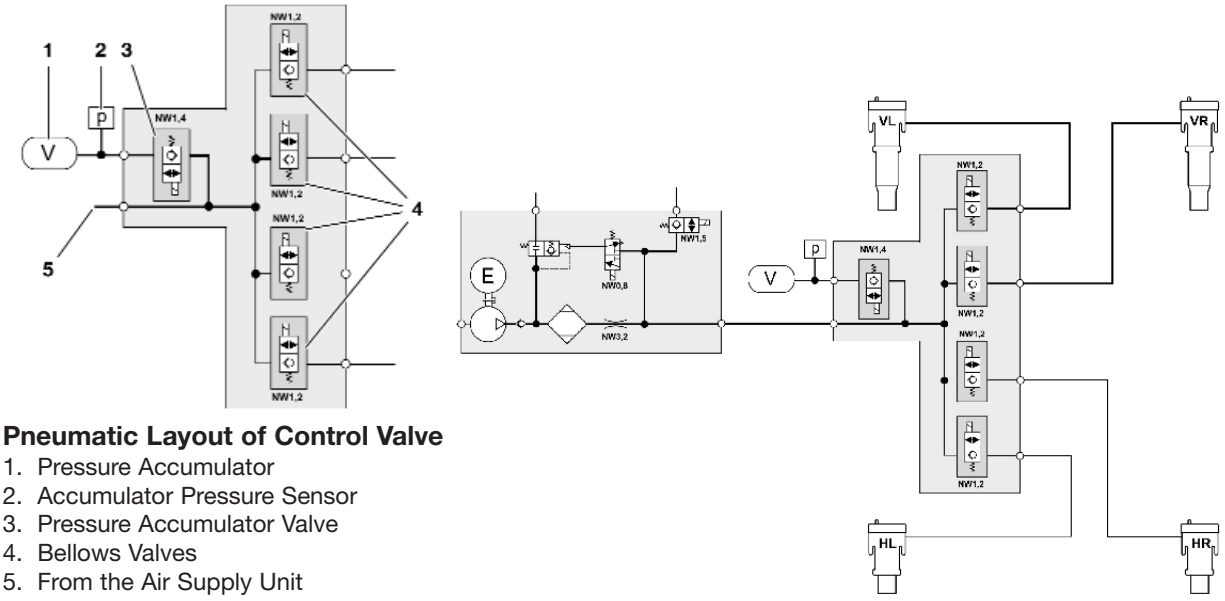
Accumulator/Valve Unit
1. Air Lines
   Yellow-Black Front
   Red-Blue Rear
2. Pressure Accumulator
3. Connecting Cable
4. Pressure Sensor
5. Valve Unit



Valve Unit
1. Connections for Air Lines
2. Pressure Accumulator valve

Valve Unit

In the valve unit, four bellows valves and the pressure accumulator valve are activated.
The bellows valves and the pressure accumulator valve are solenoid valves which are closed under spring pressure when de-energized.

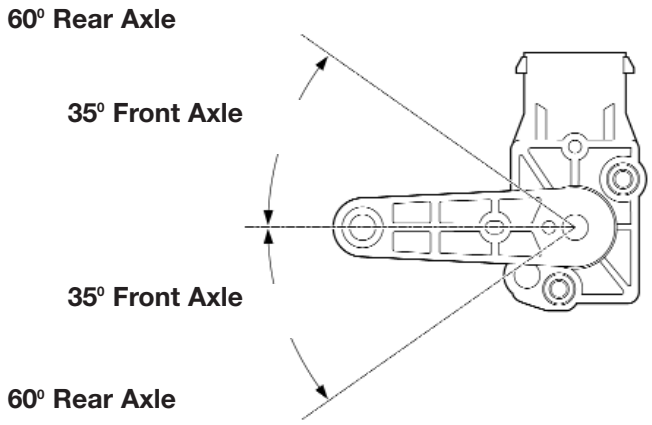


Pneumatic Layout of Control Valve
1. Pressure Accumulator
2. Accumulator Pressure Sensor
3. Pressure Accumulator Valve
4. Bellows Valves
5. From the Air Supply Unit

NW Size of opening/tubing size in mm.

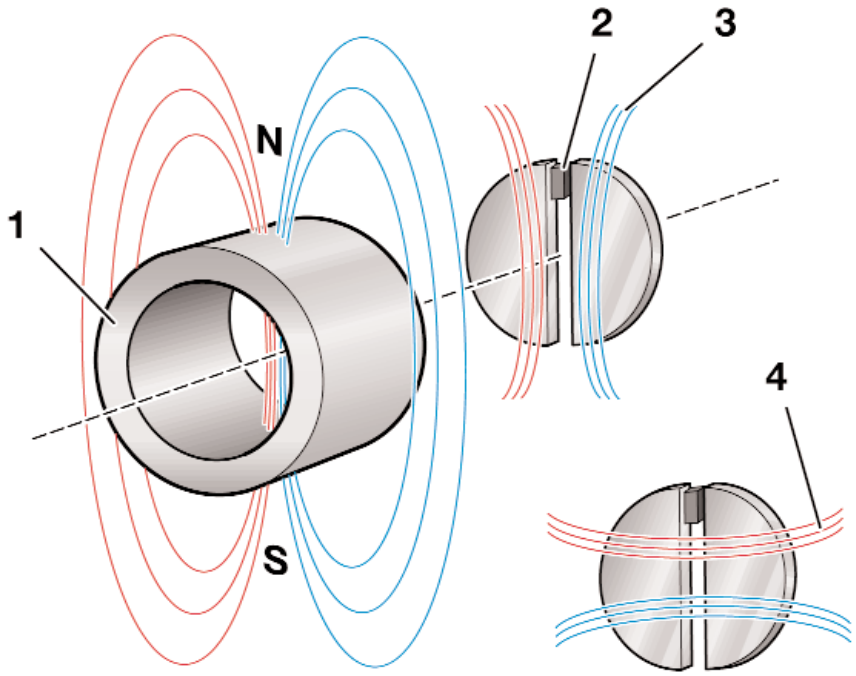
Ride Height Sensor

The control unit obtains information about the ride height of the vehicle via a ride height sensor attached to each of the four wheels.



Ride Height Sensor

The ride height sensor is an angle Hall sensor which is activated by a ring magnet. The ring magnet is polarized vertically from north to south.
The magnetic field line of the ring magnets intersect a Hall cell. The Hall cell is arranged in such a way that only the horizontal components of the field lines are evaluated. This results in different field line strengths at different positions of the ring magnet. The Hall cell measures the field strength of the magnetic flux and converts it into an analog signal with a voltage level between 0.5 and 4.5 V.



Sensor Principle of Operation

1. Ring Magnet
2. Hall Cell
3. Longitudinal magnetic field lines, low voltage 0.5V
4. Transverse magnetic field lines, high voltage 4.5V

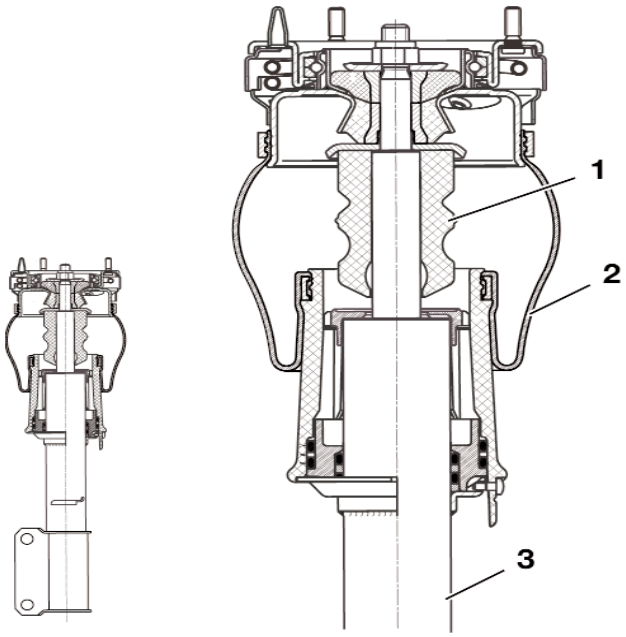
Air Suspension Strut

Rear

Minor modifications were made to the rear axle air springs. The air springs and the dampers are configured separately at the rear axle.

Front

The air suspension replaces the steel suspension at the front axle, i.e. the spring bellows is attached to the damper. The front air suspension strut and the impact absorber form a complete unit.



Air Suspension Strut
1. Auxiliary Spring
2. Air Bellows
3. Damper

Control Unit

The EHC2 Control Unit is located behind the glovebox adjacent to the General Module. The connector is a black 54 pin connector.
Inputs received directly into the control unit are:

Ride Height Level Sensor (X4)
General Module (Load cutout signal)
K Bus Inputs
Compressor Temperature
Up and Down requests from the switch assy.
CAN Bus Inputs
Pressure Sensor

Outputs include:

Air Unit Control (Activation)
LED's for Switch Unit
Pressure Accumulator
Front and Rear Axle Valves
Compressor Relay

Switch Assembly

The dash mounted switch assembly supplies a momentary switched ground to the EHC2 Control Unit requesting a ride height change in the up or down direction. Three LED's provide current ride level selected and target ride level if a request for change has been made. The LED for the current ride height will always be illuminated. The LED for the target ride level will flash until the new ride level is reached.

Notes:

Principle of Operation

Ride Height Control Operations

In addition to the automatic ride-height control system for payload compensation, the driver can set three different vehicle ride heights.

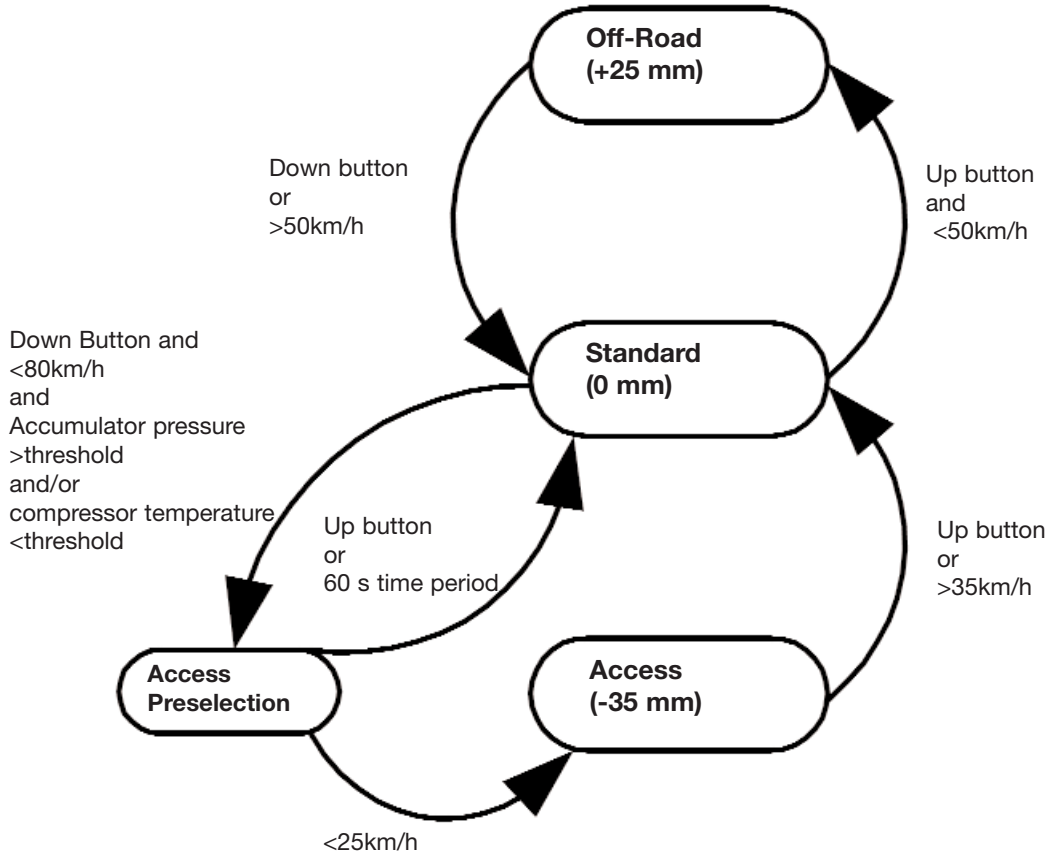
- Off-road (+25 mm), high ground clearance to a max. speed of 50 km/h
- Standard (0 mm), normal ride level
- Access (-35 mm), for entry and exit, loading and unloading to a max. speed of 35 km/h or can be activated in Standard mode at road speeds < 25 km/h

The various heights are selected by scroll rocker. Light emitting diodes indicate the present ride height setting.
Ride height can be adjusted from terminal 15 and with the doors closed. The hood and tailgate may be open.

The system also controls inclination automatically, like the single axle air suspension.

All control operations are executed without stopping at intermediate levels. The vehicle is configured pneumatically in such a way that the front and rear axles can be lowered in parallel in any load situation. Depending on the load situation, either the front axle or the rear axle is slightly quicker. On account of the different control speeds, a difference in height between the two axles is possible during all control operations. If a max. permissible threshold is exceeded, the quicker axle is stopped briefly.

The various levels can be preselected while travelling. Changeover between ride levels is effected at the speed threshold values defined in the control unit. The control unit monitors the change-over.
As soon as the driver sets a new target ride level by pressing a button or when a changeover is initiated automatically by a specific driving condition, the LED for the current ride level remains lit and the LED for the target ride level begins to flash.
When the new level is reached, the LED for the previous level goes out and the LED for the new level reached stays lit permanently.



The various levels can be preselected while travelling. Changeover between ride levels is effected at the speed threshold values defined in the control unit. The control unit monitors the change-over.

As soon as the driver sets a new target ride level by pressing a button or when a change-over is initiated automatically by a specific driving condition, the LED for the current ride level remains lit and the LED for the target ride level begins to flash.

When the new level is reached, the LED for the previous level goes out and the LED for the new level reached stays lit permanently.

If a ride level selection is not allowed, the LED indicating the momentary ride level of the vehicle flashes for 3 seconds.

A special case is preselection of Access levels while travelling. The Access LED flashes and the LED for the original ride level is lit permanently. However, this does not mean that a control operation has already begun. The control operation does not actually begin until the speed threshold which the Access level allows is reached or undershot.

In addition to the LED indicator, the following text messages can be displayed in the instrument cluster:

- *TRAILER MODE*
  A coupled trailer is identified via the trailer connector. To avoid damaging the trailer and the vehicle, changes of vehicle level are generally avoided. The standard level is "frozen." If the trailer is coupled at a level other than the Standard level, the vehicle ride level is not changed to Standard unless a button is pressed or the speed threshold for automatic change-over is reached. The standard level is then "frozen" until the trailer connector is disconnected.
- *RIDE HEIGHT CONTROL INACTIVE*
  Faults in the system and on the control unit which are only identified by the instrument cluster, e.g. control unit disconnected
- *RIDE HEIGHT CONTROL INACTIVE + MAX. 60 km/h*
  For safety-critical faults (vehicle is too high or at inclination)

Control Modes

Sleep mode
If the vehicle is parked, it enters Sleep mode after 16 minutes. No further control operations are executed. A "watch dog" wakes up the control unit for a few minutes every 6 hours (wakeup mode) in order to compensate for possible inclination of the vehicle. (Vehicle height may only be corrected once as air supply unit only operates with engine running.)

Wake-up
In wake-up mode, the control unit is woken up for a set period of time in order to compensate for possible inclination of the vehicle. Inclination of the vehicle can be caused by large temperature differences or by minor leaks. Adjustments to the front and rear axles ensure that the vehicle is visually level. To minimize power consumption, the vehicle is lowered only. The nominal level of the lowest wheel serves as the nominal level for all other wheels. The lowest nominal level to which the vehicle is lowered is the Access level (-35 mm).
Exception: if the vehicle is parked at Access level, the vehicle is lowered to max. -50 mm in wake-up mode. If the vehicle is parked for a prolonged period of time and there is a leak in the system, further loss of pressure does not produce a change of ride level since the weight of the body is born by the auxiliary suspension and the residual tire pressure.

Advance /Overrun
When the vehicle is woken out of sleep mode by the load-cutout signal (VA), it normally enters advance / overrun mode. Since the engine is not (no longer) running in this mode, however, there are restrictions on the control operations that can be performed in order to conserve the battery. Ride level compensation is restricted to tolerance ranges of 20 mm and 25 mm in the up and down directions respectively. This serves to reduce the frequency of control operations.

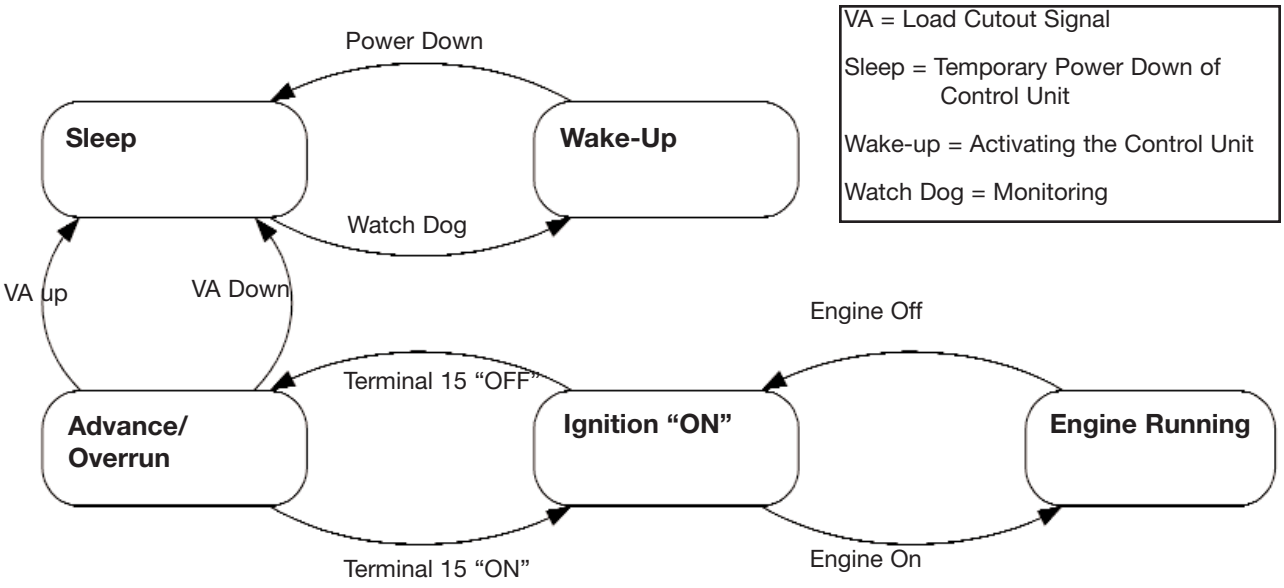
All control operations in advance / overrun mode are executed as long as pressure is available in the accumulator. When the accumulator is empty and the engine is turned off, control operations are directly driven by the compressor. User-activated changes of ride level and filling of the accumulator are not possible.

Terminal 15

As soon as the ignition is turned on (terminal 15), the user is allowed to lower the ride level as required.
However, it is still not possible to raise the ride level or fill the accumulator.
Ride level is compensated outside a narrow tolerance range of 10 mm upwards and 10 mm downwards.

Engine "on"

Ride level compensation, raising and lowering the vehicle's ride height as well as filling the accumulator are permitted when the engine is running. The compressor also starts up during every control operation.
Ride level is still compensated outside the narrow tolerance range of ±10 mm.
As long as the vehicle is stationary, high speed filtered ride level signals are used to detect a change of load. This allows the system to react immediately to changes in ride level.
As soon as the vehicle is travelling, it changes over to low speed filtered ride-level signals. The system no longer reacts to bump movements caused by road surface unevenness. A mean value is formed over a prolonged period of time, i.e. payload is only altered by the progressive emptying of the fuel tank.
The high speed filter is not used until the vehicle is stationary again and a lid is opened. If no lid is opened, the vehicle logically cannot be loaded or unloaded.



Workshop Hints

If a threshold level is exceeded on all 4 wheels when the vehicle is stationary, the control unit assumes that the vehicle has been raised on a workshop platform.
There are three possible reset conditions for workshop platform recognition:

- The original level values are undershot at all four wheels,
- A selection is made by button,
- A speed of >40 km/h is recognized for 3 s.

Vehicle jack

If the lowering speed at a wheel is too low during the lowering operation, the system assumes that the wheel is jacked up. However, the downward velocity must be less than a certain preprogrammed speed threshold. If the system detects a jacked wheel, it stores the height of this wheel.

Car jack recognition is reset when the stored ride height is again undershot. When a travelling speed of 40 km/h is maintained for at least 3 s, another control attempt is performed. The car jack recognition can also be reset by button selection.

Please note that the system also controls ride height in diagnostic mode. For this reason, Belt Mode must be activated before carrying out work on the system or before setting the vehicle ride height.

Belt Mode:
Heights are fixed and are not compensated. If Belt Mode is set, the function LED is off. The text message "ride-height control system inactive" appears in the instrument cluster.

Transport Mode:
The Transport Mode setting is for transportation purposes. When the ignition is turned on, the message "ride-height control system inactive" appears. Heights are increased or decreased depending on ignition key status, e.g. ride height is reduced when the vehicle is lashed to a ship or train and raised when the "Engine on" signal is generated and when the vehicle is transported on a transporter truck.

The correct ride height is set to ± 5 mm via "Activate components." The left and right ride levels are set separately at the rear axle. The ride levels are then set at the front axle. The left and right air springs are adjusted jointly for this purpose.
Following this, the new ride height for the front and rear axles is stored via the "Offset function."

Before replacing components, the system must be depressurized! This is done in the diagnostics via "control unit functions," "Component activation," "Pressure-relieve front axle/rear axle." Repeat the activation procedure 6 times.

If the fabric of the bellows is visible, then the bellows must be replaced.

Upon completion of repair work, the air suspension system of the vehicle raised on the workshop platform must be refilled with air via the diagnostics. The activation procedures must also be repeated 6 times. This prevents the bellows from being folded incorrectly.
The vehicle must with be set down on its wheels when the suspension struts are depressurized!

Important Workshop Hint
Similarly, a defective vehicle with leaky pneumatic system must not be raised on the workshop platform. If depressurized, the bellows would contract under suction forming incorrect folds. These folds could result in malfunctions later on.

Areas on the air bellows which can possibly become leaky are the O-ring at the piston rod and the seal carrier on the roll piston.

The connectors attached to all cables are identical to the connections on the single-axle air suspension. 6 mm cable is used. The tightening torque is 3 ± 1 Nm throughout the system. Special care must be taken when handling breakage-prone plastic parts of air suspension elements.

Upon completion of repair work, Belt mode must be deactivated via the diagnostics. The function LED on the button comes on. No text message appears in the instrument cluster. The system is OK and ready for operation.

Steering

The X5 utilizes a power assisted rack and pinion steering system due to all wheel drive considerations. The power steering pump is a vane cell design.

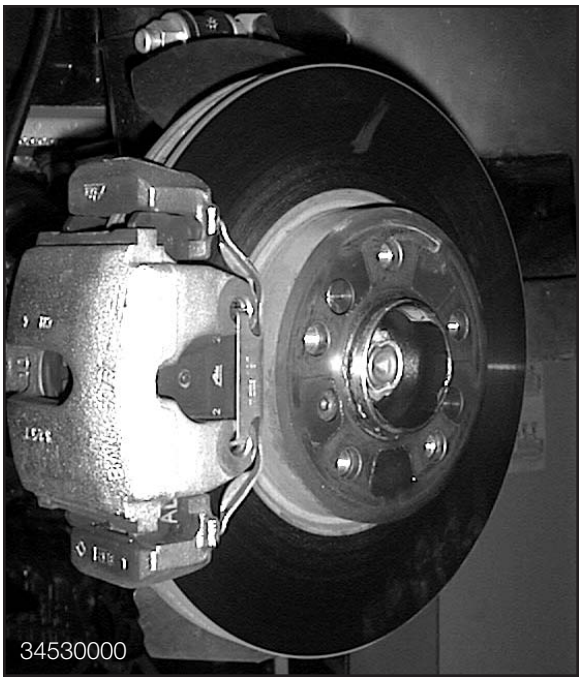
The turning radius of the X5 is 12.2 meters.

The steering column is electrically adjustable for length and height that includes the memory function incorporated into the seat/mirror memory system.

Brakes

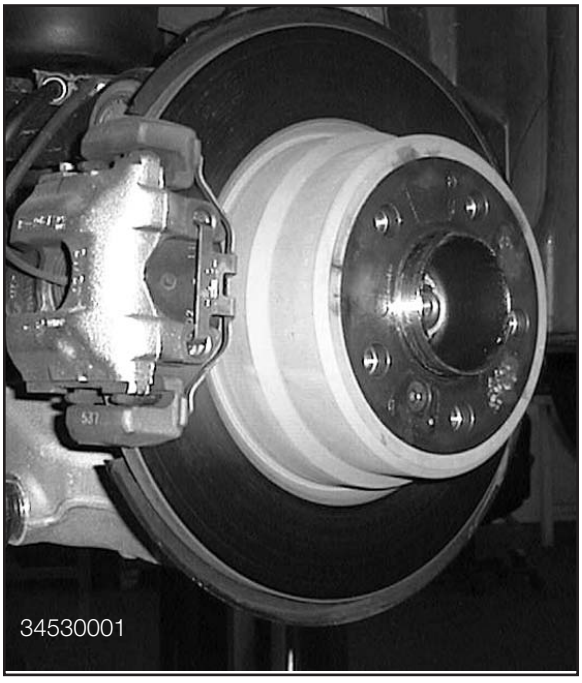
The X5 brake system is the dual circuit (black/white) division with Electronic Brake Force distribution (EBV) through DSC control. The system is similar to the E38 with:

- Vacuum booster with tube jet amplifier
- Tandem master cylinder with two central valves for DSC operation
- Brake fluid reservoir with reed contact
- Vented front rotors/Solid rear
- Single piston calipers
- DSC hydraulic unit with integrated control module
- Pre-load pump for DSC operation



Front Brakes

Brake Rotor - 332mm diameter - 30 mm thick
Caliper - single piston 60mm diameter
Pads - asbestos free



Rear Brakes

Brake Rotor - 324mm diameter - 12mm thick
Caliper - single piston 42mm diameter

Wheels and Tires

Light alloy wheels are standard equipment on the X5. The wheels sizes include:

3 Liter version

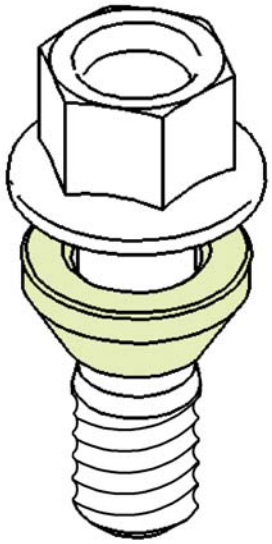
- Standard Wheel - 7.5J x17 SEH2
- Standard Tires - 235/65R - 17 H rated all season Front and Rear

4.4 Liter version standard suspension

- Standard Wheel - 8.5J x 18 EH2
- Standard Tires - 255/55R - 18 H rated all season Front and Rear

4.4 Liter version sports suspension

- Standard Wheels - 9J x 19 EH2 FRONT
  10J x 19 EH2 REAR
- Standard Tires - 255/50R -19 Front/285/45R - 19 Rear V rated

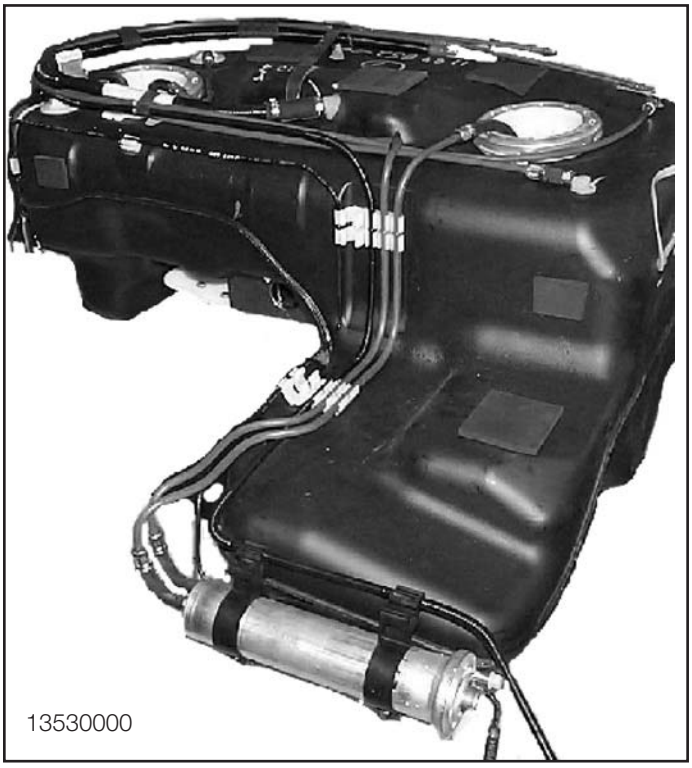


The X5 uses a two piece lug bolt that incorporates a spacer washer and features anti-corrosion coating. The tightening torque on the lug bolts is 130Nm +/- 10Nm. Advantages of using the spacer washer include:

- Longer expansion length for the bolt.
- A better fit to the wheel
- The spacer washer is fixed to the wheel when tightening and the lug bolt turns relative to it.

Fuel System Supply

The fuel tank is constructed from molded plastic and is mounted under the rear seat and extends along the left side of the vehicle. It is the saddle tank design with a siphon jet pump in the right side to transfer fuel to the left side where the fuel pump is mounted.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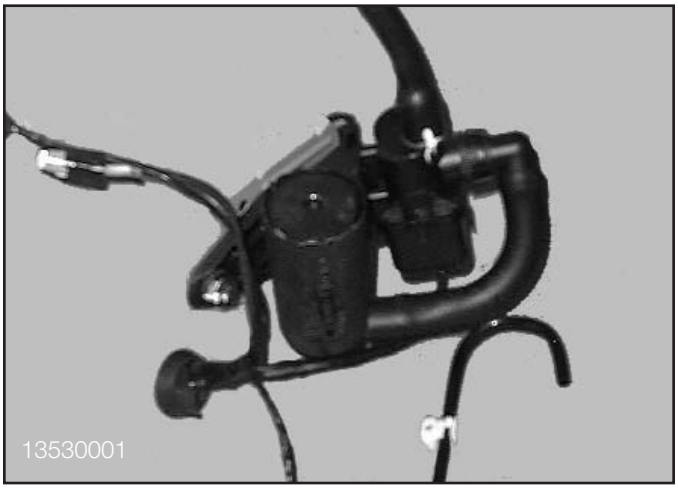
The fuel filter/pressure regulator is mounted in front of the tank along with the charcoal canister. The components are covered by a plastic plate to protect them when driving off-road.

The liquid/vapor separator is mounted on the right side up in the wheel arch opening next to the filler neck.

The Leak Diagnosis Pump (LDP) is mounted in the left rear side wheel arch opening behind the wheel housing cover. Operation of the LDP will be covered in the engine electronic section of this program.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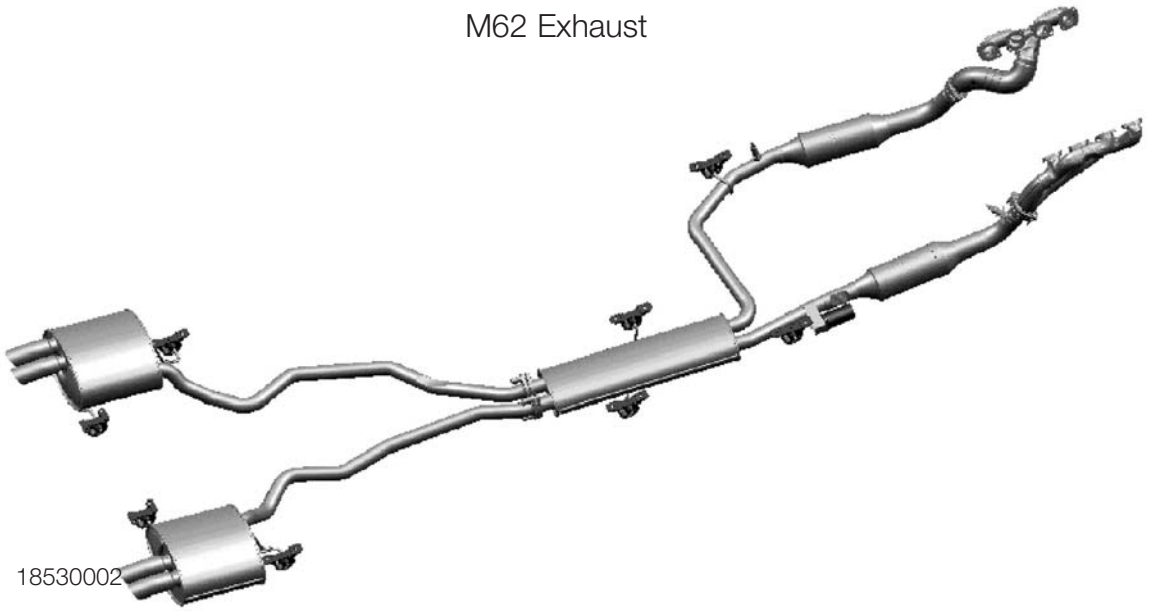
Exhaust System

The exhaust system of the X5 is made from stainless steel and consists of three main pieces after the exhaust manifolds. The front section consists of two monolith catalytic converters with pre and post-oxygen sensors. The two converters converge into one center muffler on the right side of the vehicle.

The two rear sections consists of the tail pipes and main mufflers that are mounted at the rear of the vehicle.

The front and rear exhaust components are bolted together with spring bolts

M62 Exhaust



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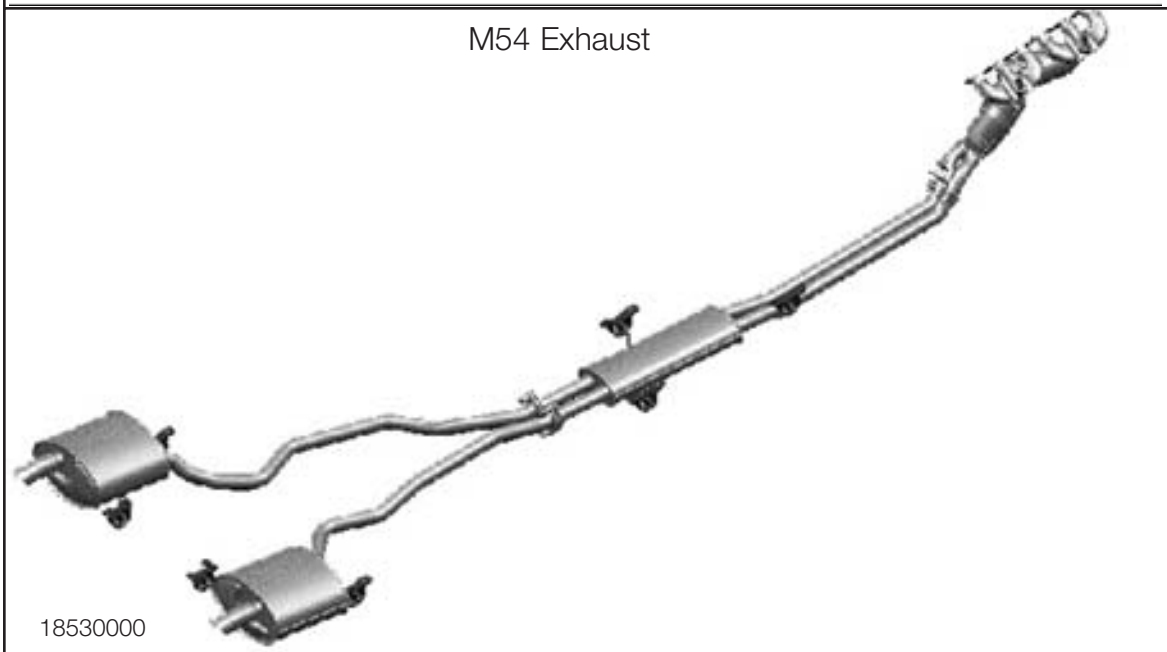
M54 Exhaust



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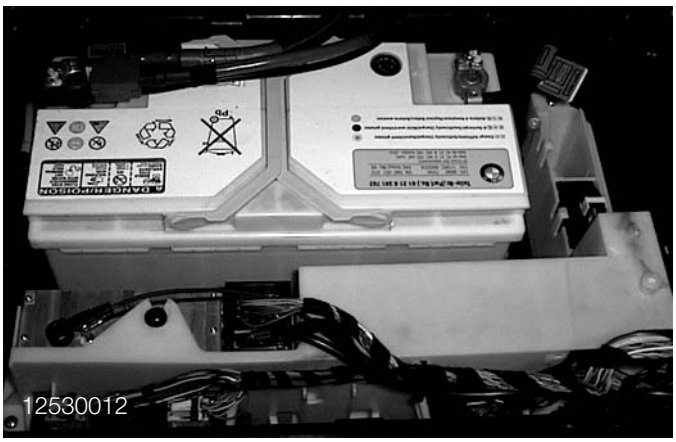
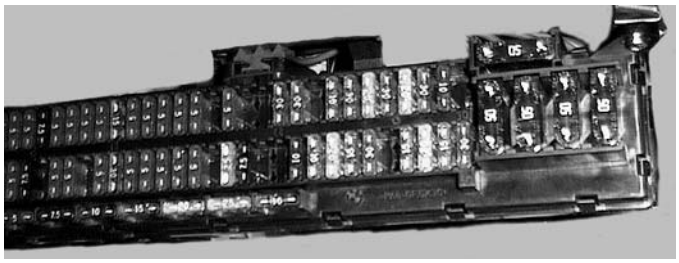
Power Distribution

The maintenance free 90 AH battery in the X5 is mounted in the rear below the spare tire and EHC compressor unit. The battery box is formed of molded plastic and the positioning of the battery aids in weight distribution. As with all BMW vehicles, the battery is equipped with the BST on the positive battery cable.



Power distribution for the vehicle and systems is through two fuse carriers mounted in the right storage compartment in the rear and above the glove box in the front.

The battery jump/charge point is located in the engine compartment on the left side of the fire wall.



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Component Location